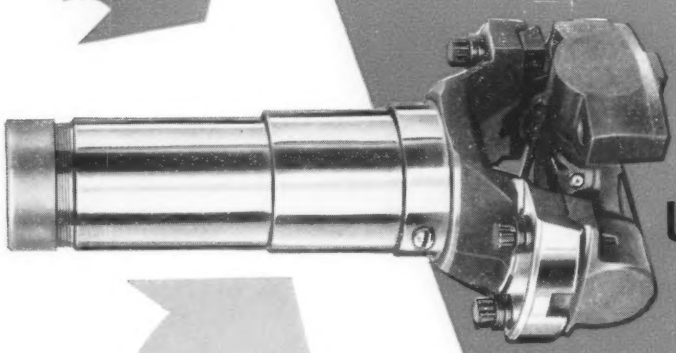
Design Engineering

FIVE DOLLARS A YEAR PUBLISHED BY THE MACLEAN-HUNTER PUBLISHING COMPANY LIMITED, TORONTO, CANADA AUGUST 1961

MORE MUSCLE IN A SMALLER PACKAGE... THE NEW

BLOOD BROTHERS "58WB" UNIVERSAL JOINT



To meet new drive line requirements on its 1961 model trucks, a major truck manufacturer needed a special, lightweight but strong universal joint—a unit that would provide greater torque capacity without increasing swing diameter. Rockwell-Standard engineers were consulted, and in a cooperative effort the new "58WB" was developed. It is now being used on several models in the manufacturer's 1961 line.

The design of the new "58WB" is applicable to medium-weight trucks, off-highway equipment, small crawlers and front-end loaders of approximately 1½ yards capacity. It can be made up as a complete drive line, furnished as a component part for a manufacturer's own drive line, or utilized in close-coupled drives. The "58WB" offers these outstanding advantages:

★ **More capacity than any joint of comparable size.** The "58WB" provides 39,000 inch pounds torque capacity with a swing diameter of only six inches!

★ **Key-type yoke.** Requires only four bolts for installation on original equipment. Saves downtime for repairs.

For more details about the new "58WB" or for help in solving any problems involving universal joints or drive lines, write or call us today.

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Universal Joint Division, Allegan, Michigan

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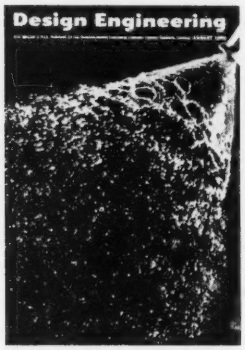


This month's cover

Spray nozzles are an everyday commodity with which even the youngest of our readers is familiar. From baby oil to fuel for the furnace, metering is done by spray. Ron Vickers, ARPS, our cover photographer, recorded this study (and was nearly drowned while doing so) to draw attention to our lead story this month on spray nozzle design and application.

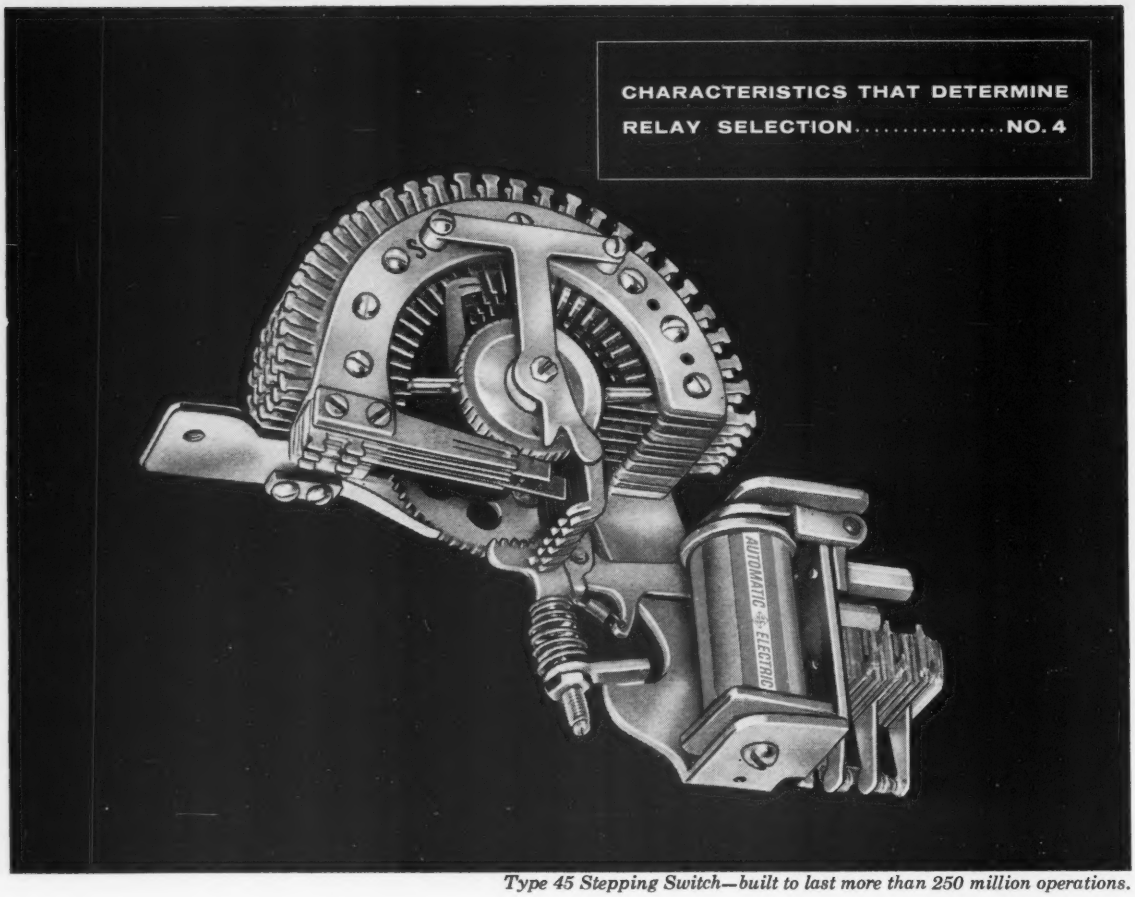
In this issue

Departments

Reader Service

Before reading further, turn to the back of the book and tear out a Reader Service Card. Circle the numbers as you go and mail the completed card to us—no postage is required. We will take care of your requests immediately.

Pass your copy along so that others may enjoy this service—there are three cards.



Type 45 Stepping Switch—built to last more than 250 million operations.

where extra-large capacity is required

Helpful selection data
Type 45 stepping switch

CAPACITY
Twelve 25-point, eight 50-point bank levels

OPERATING VOLTAGE
any d-c voltage up to 110, or 115 volts, 60 cycles a-c, with rectifier

DRIVING MECHANISM
Pawl and ratchet type, spring driven.

OPERATING SPEEDS
Self-interrupted, 60 steps per second or more.

The Type 45 high-speed rotary stepping switch, by Automatic Electric, has exceptional capacity and can be used for a tremendous variety of applications. Ruggedly built and capable of performing more than 250 million operations—with complete reliability—it will function at speeds of 60 steps per second, or even more. The contact bank is built up on a one-piece frame, to provide up to twelve 25-point bank levels or eight 50-point bank levels, with no alteration in base construction, and with no decrease in structural strength.

The switch is spring driven, and either self-interrupted or impulse controlled. A specially designed armature steps the wiper assembly from one position to the next, and automatically locks the rotor in position. This is a unique feature that eliminates wiper overthrow completely.

The Type 45 is the finest, most reliable switch of its kind on the market—the switch used and proven in telephone exchange equipment everywhere in the world.

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Subsidiary of
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GENERAL SYSTEM

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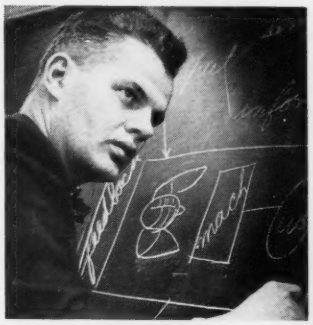
The contributors



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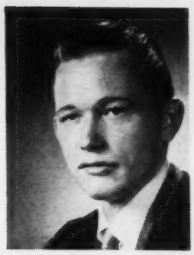


Knapp

Skinner

Ken Jay, who contributed the article on spray nozzles, is quite an inventor. He's had seven patents issued in his name, mainly for lubricating and fuel systems which he designed in his role as an engineer in the Industrial Group at Orenda Engines Limited, Toronto. Most of his work today is on industrial gas turbines.

A graduate from University of Toronto, Ken joined Orenda in 1947 and spent some of his spare time working on a graduate course in Feedback Control Systems which he completed a couple of years ago. He lists his hobbies as model building and photography and is a church organist and choirmaster.

Thomas Baxter arrived in Canada from the United Kingdom in 1947 and set out to learn his new country the hard way, with a round-trip by bicycle from Niagara to Algonquin Park, covering about 600 miles. He had developed an enthusiasm for cycling by pedalling his way 700 miles around Scotland, about ten years previously.

Tom worked as a designer with the big British electrical manufacturer Thomas-Houston Company, and joined Leland Electrical Company Limited, Guelph on coming to Canada. He designs jigs, dies and special tools. In this issue he offers ideas for using fluid power in the home.

George Soulis spends a fair amount of his time teaching the theory of industrial design and his knowledge is backed by some good practical experience. After leaving the University of Toronto in 1950 he went to T. S. Simms & Co., Saint John, N.B. as a product development engineer. He then served as product designer with the Kitchener furniture manufacturers Snyders Ltd., and later as factory manager.

With grants from the University of Waterloo he was able to study industrial design in Europe and is now assistant professor in the Department of Mechanical Engineering. He authored the article on the industrial designer.

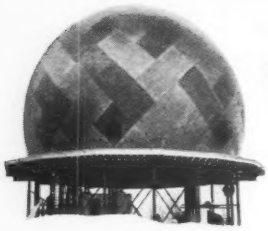
Harold Skinner, who discusses technical education, finds teaching a rewarding and challenging profession. And it's no wonder since he can number some top award winners among his pupils, especially the recipient of Ford Motor Company's international award for mechanical drafting (1960).

Harold spent six years in engineering design at General Motors followed by three years with Salem Engineering. He then took a course similar to that outlined in his article and began teaching at Weston Collegiate and Vocational School in Toronto. Today he is technical director of Victoria Park Secondary School where he is supervising the rebuilding and expansion program. As this issue comes off the press he will be anxiously awaiting two important events . . . graduation with an education degree from Wayne State University, Detroit, and the birth of his first child.

Arnold Knapp writes technical articles as part of his regular work. That's why we asked him to summarize design techniques for investment castings. Matriculating from Danforth Technical School he studied metallurgy at Ryerson Institute of Technology, Toronto. He graduated with honors and went straight to a job as technical writer with the Canadian Copper and Brass Development Association. Today he's assistant to the manager.

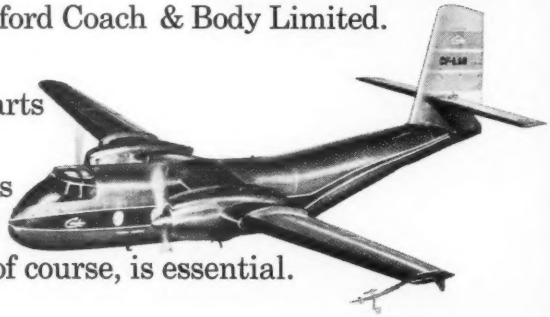
Fiberglas Reinforced Plastics have the greatest strength-to-weight ratio of any known material. And other remarkable qualities make them one of the most versatile and economical materials for a wide variety of applications . . . in the development of new products . . . to improve present products or processing equipment.

Take this design award winning FRP park bench, a product of Polyfiber Limited. Practically indestructible. Proof against any weather. Permanently gay and colourful. The colours are moulded in.



Or this radar dome made of Fiberglas Reinforced Plastic by Long Sault Woodcraft Limited. Light enough for easy transportation over difficult terrain. Strong enough to withstand constant lashing from subarctic gales. Impervious to snow and ice. Weathertight to protect delicate mechanism.

FRP tank trucks are lighter, use less fuel. Reduce wear and tear on moving parts . . . carry greater live loads at less cost. And they're corrosion resistant. This tank truck was built by Canbar Industrial Plastics Division of Canada Barrels and Kegs Limited in conjunction with Brantford Coach & Body Limited.



The 500 or so Fiberglas Reinforced Plastic parts that go into the de Havilland Caribou are a good example of the way specialized shapes can be produced inexpensively in limited quantities. A strong, lightweight material, of course, is essential.

The potentials of Fiberglas Reinforced Plastics are virtually unlimited. You can use them for the high temperature resistance of a missile nose cone or for the acid resistance of a chemical vat; for the minuteness of a small electrical component or the massiveness of a 50-foot boat hull. Our experienced sales specialists and a highly developed Canadian moulding industry are ready to serve you. **T.M. Reg'd.*

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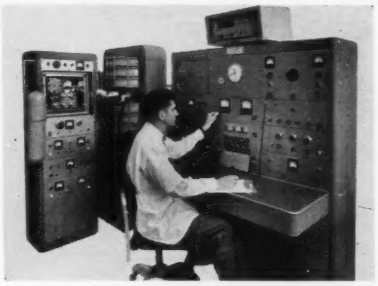
Reports — A world roundup of engineering and design interest

Advanced analysis points to life on other planets



The first physical evidence of life outside our own planet has been reported by a team of scientists from Fordham University and Esso Research and Engineering Company. They had just analyzed pieces of a 97-year-old meteorite using a mass spectrometer, infrared and ultra-violet spectroscopy, and x-ray diffraction technique.

A stream of electrons in the mass spectrometer broke up the molecules of an organic sample from the meteorite, giving a series of electrically charged particles which were sorted according to their molecular weight. Analysis revealed the presence of paraffinic hydro-carbon molecules which contain from 19 to 23 carbon atoms. They are similar to the molecules found in the skins of grapes and apples and are produced on earth only by living matter. Test data also proved agreeemnt with the known distinctive distribution of normal paraffin in life forms.

Summing up, the research team said "it appears that biogenic processes occur and that living forms exist in regions of the universe beyond the earth." *Source: Consolidated Electrodynamics Corp.*

Circle 300 on Reader Service Card

Computer automatically cross-indexes document titles

Scientific documents can now be swiftly and automatically indexed, according to important words in the titles, by an electronic digital computer. The titles, on punched cards, are fed into the computer with other cards containing the names of authors and identification numbers. It scans them, recognizes the information, and prints out a "permuted title" subject index where each significant word of the title appears in turn as the key word. For example, the title "Application of the Fourier Integral in Circuit Theory" appears in the permuted index in three places:

APPLICATION OF THE FOURIER INTEGRAL IN CIRCUIT THEORY
OF THE FOURIER INTEGRAL IN CIRCUIT THEORY. APPLICATION
THEORY. APPLICATION OF THE FOURIER INTEGRAL IN CIRCUIT

The three key words "integral," "circuit" and "Fourier" are positioned at the index column running down the centre of the page. All other words are classed as nonsignificant and the computer is trained to disregard them.

The computer stores the permuted title subject indexes in its memory. When all document titles have been permuted it reshuffles them and produces on magnetic tape a comprehensive index in which all titles are listed alphabetically according to their key words. The tape is fed into a high speed printer which spells out the index, in English, at 600 words per minute. The "brain" does the job so fast that in one application it took only 12 minutes to index 1,700 documents according to title, author, number and project. *Source: Bell Telephone Laboratories.*

New design for lighter, cheaper transformers

New transformers that could be lighter and less costly than their conventional counterparts have been successfully developed in a U. S. cryogenic laboratory. A research model, operated at a level of 15 kilowatts, has shown that the new design may give freedom from substantial power losses caused by electrical heating, and the temperature limitations of present-day electrical insulation.

The new transformer makes use of superconductivity—the ability of certain metals to conduct an electric current without any resistance at temperatures near absolute zero. While superconducting transformers have been considered before, the obstacle has been the fact that a moderately strong magnetic field (such as would exist around the transformer coils) can quench the superconducting state by restoring electrical resistance. The new design solves this by using interleaving layers of the primary and secondary windings which set up opposing magnetic fields that almost cancel each other out.

Cooling is achieved by a helium refrigerator, also a new development, which produces temperatures to minus 452 F and maintains them unattended for months of continuous operation. Only the coils themselves are cooled, while the cores are kept at room temperature. Heat leaks are controlled by vacuum insulation, liquid nitrogen heat shields and an ingenious arrangement of the superconducting input leads. *Source: Arthur D. Little, Inc.*

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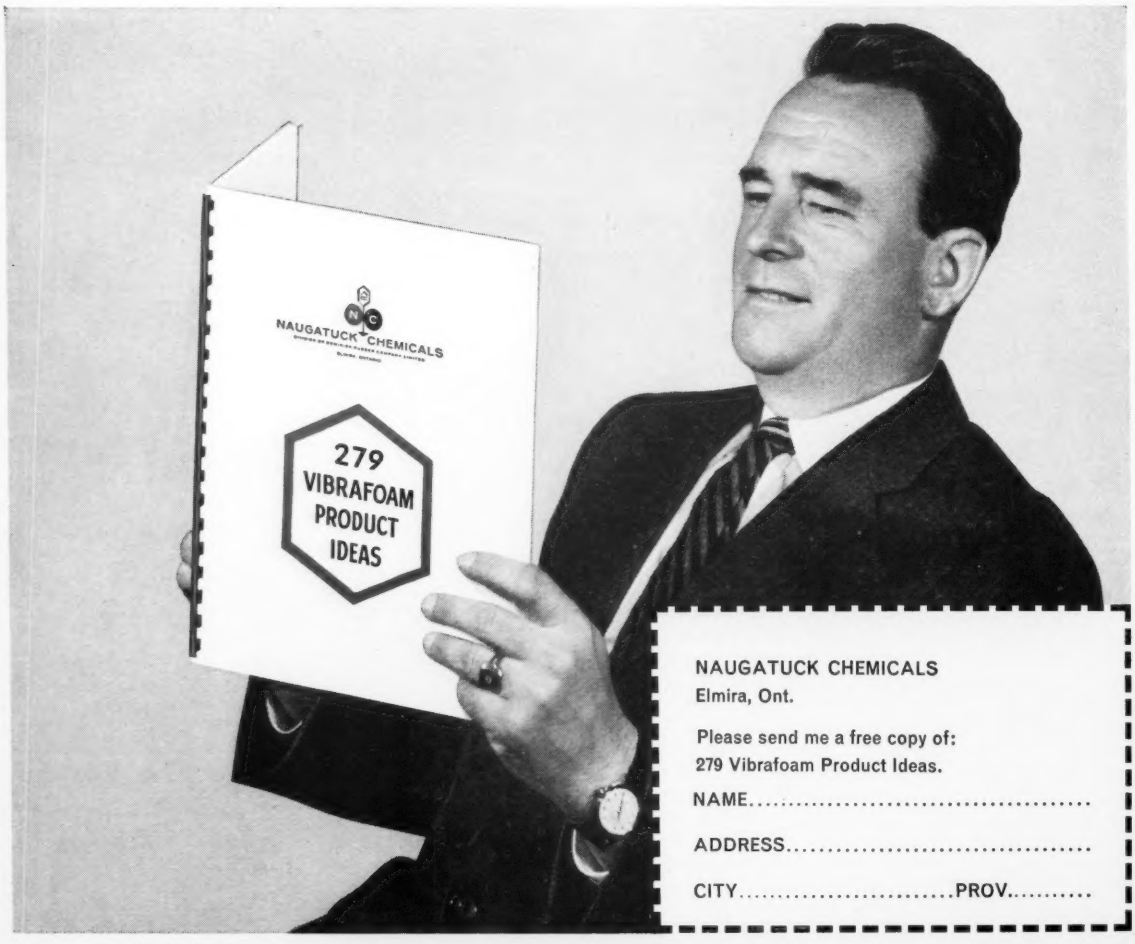
ONE OF THESE IDEAS MAY BE WORTH A MINT OF MONEY TO YOU

Here is a booklet with 279 ideas for products using Vibrafoam. Some are frankly trivial, but others are practical products you can start developing today. And any of them could be a springboard for your imagination in thinking up your own exclusive application.

All are based on the proven properties of Vibrafoam, Naugatuck's two component rigid polyurethane foam system. They exploit its light weight . . . its insulation efficiency, with a "k" factor only half that of most commercially available insulation products . . . its relatively high compressive and tensile strength . . . its closed cell structure . . . its ability to foam in place to fill any void . . . its high bonding strength to most surfaces . . . and its easy handling with simple, inexpensive equipment.

So send for your free copy of "279 Vibrafoam Product Ideas" — while the coupon is handy and you have it in mind. You'll be glad you did!

279 VIBRAFOAM PRODUCT IDEAS



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Elmira, Ont.

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Labor-saving design for Canadian loggers

A simple attachment designed by a B. C. forest operator and worth a mere $2,500 has vastly increased the potential of a $100,000 skagit loader. The skagit was bought for loading trucks with logs after they'd been hauled from the forest and dumped at the roadside with awkward equipment. But the length of its boom (24 feet) restricted its effective pick-up to a small radius.

Its owners struck on the idea of greatly increasing its range by adding a telescopic arm on top of the boom to carry the line and pick-up tongs deeper into the woods. It could then lift the logs straight out of the forest where the logs once had to be carried out by hand.

The snorkel attachment, powered by a simple system of lines and sheaves, travels out dragging the line and tongs with it. When the chokerman places the tongs around the log, the snorkel is retracted as the original skagit steps in to pull in the log. Because the snorkel itself does not perform any heavy duty the only reinforcement necessary is a steel plate running along the top of the skagit's beam. The simple, but practical idea increased the effective working range of the equipment from 24 to 66 feet. *Source: Crown Zellerbach Canada Ltd.*

Ancient Roman masonry art suggests new Canadian industry

By applying modern technology to an ancient Roman art Canadian researchers are on the verge of developing a new commercial building cement that will utilize shale deposits in southern Ontario and mine tailings from northern Ontario. A technique has been demonstrated that turns both into extremely active pozzuolanic materials ideal for producing durable mortars, concrete brick and block, firebrick and other building products.

Pozzuolans are inorganic materials that react with lime in the presence of moisture to form insoluble cement compounds. They were named after a volcanic ash used by the ancient Romans to bond some of the masonry structures that still endure today. Canadian researchers found that Ontario shale and mine wastes were pozzuolanic when following up experiments with rice husk ash. While they are convinced further study of local pozzuolanic materials will provide Canada with a new industry, they also feel it may help minimize some of the undesirable characteristics in modern masonry mortars. *Source: Ontario Research Foundation.*

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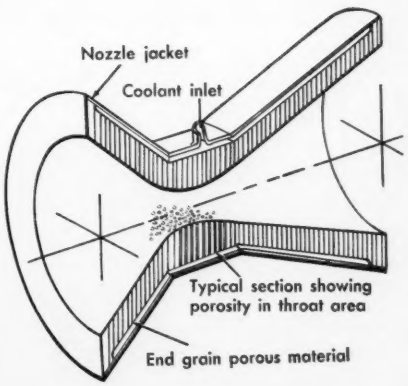
New method to help nose-cones beat re-entry friction

"Sweat-cooling" of rocket nozzles has become a practical possibility with the development of heat-resistant plastic structures with controllable porosity that can be varied to allow greater cooling at the nozzle throat than in the divergent section. Although utilization of the evaporation effect in transpirational cooling is not a new concept, it is the first time a rocket nozzle has been successfully developed to test the theory.



Cooling is achieved basically by forcing a fluid into a nozzle through porous walls and gaining rapid evaporation on inside surfaces in contact with exhaust flame. In addition the fluid flowing through the wall tends to retard outward heat passage, while a film formed inside the wall reduces heat conduction.

The porous material can be made of glass, leached-glass or quartz fabric with a high temperature phenolic resin binder. It will ablate if the coolant fails, minimizing catastrophic failure.

When a laboratory-scale structure was applied to a flame for three minutes the exposed surface showed only superficial defects. A sample without coolant was ablated to a depth of approximately one-eighth of an inch in only one minute. *Source: Westinghouse Electric Corporation.*

Back to the bar for the umpteenth time

Beer barrels are a good example of product improvement with Atlas stainless steel. In spite of countless trips, rough treatment and frequent washings, stainless steel barrels are practically indestructible. Out of 3 million now in service, only .5% have needed repair. Major industries in Canada have solved many a design and production problem with stainless steel from Atlas.

Stainless is easy to work with. No tolerance is needed for corrosion because there is no corrosion—and stainless needs no painting or plating. Many production operations can be completely eliminated.

In Canada, the largest producer of stainless steel, and the company best equipped to assist you, is Atlas. For answers to your questions about stainless or specialty steels, contact your nearest Atlas representative.

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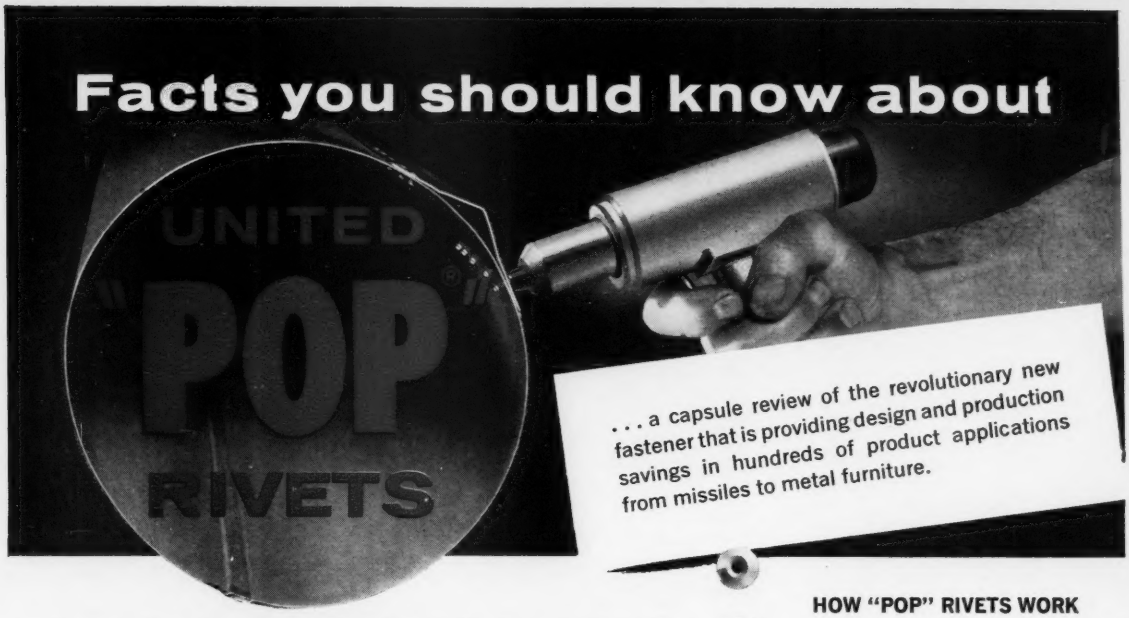

. . . a capsule review of the revolutionary new fastener that is providing design and production savings in hundreds of product applications from missiles to metal furniture.

What are "POP"® Rivets?

"POP" Rivets are high strength, precision-made hollow rivets assembled on a solid mandrel. Used in "blind" and "non-blind" applications. Made in a complete range of sizes and head styles in aluminum, monel, steel and copper. Available in both "Open-End" and "Closed-End" types.

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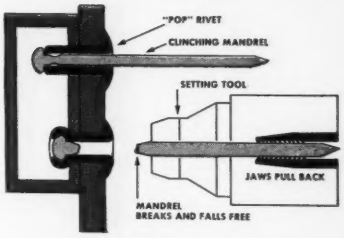

"POP" Rivets are inserted and set from the same side of the work. The retracting jaws in the setting tool pull the mandrel head into the rivet on the reverse side until the mandrel breaks under tension. This high clinch action pulls parts together exerting up to 600 lbs. squeeze and produces a tight, positive, vibration-proof fastening over a wide range of stock variations.

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Discover this new way to simplify design, improve quality and speed production. Introductory kit contains approximately 240 "POP" Rivets in various lengths and materials together with a hand setting tool. Complete with instructions and application hints. "POP" Rivets can save as much as 50% on installed costs!

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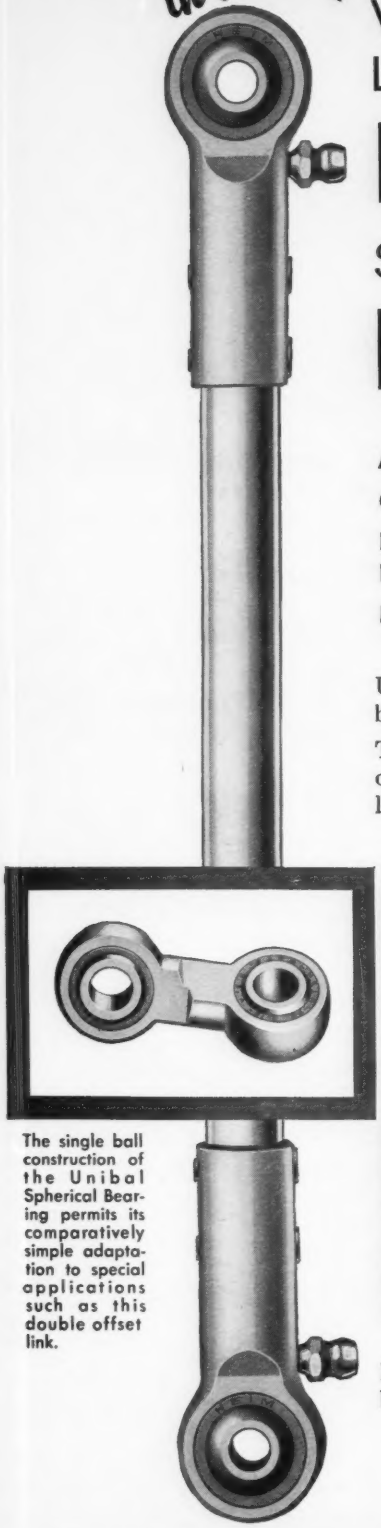
Unibal is the original spherical bearing with the single ball set in bronze bearing inserts, designed, engineered and built by The Heim Company.

They are available from your local bearing distributor in a wide range of sizes and materials, including sintered metal components, and teflon linings for self-lubrication.



The single ball construction of the Unibal Spherical Bearing permits its comparatively simple adaptation to special applications such as this double offset link.

Heim Unibal Rod Ends as used in the linkage for the dampener installation on the Atlas fuel manifold.

Heim Unibal Spherical Bearing assembled with the variable pitch stator vanes in the jet engine, act as the pivot points.

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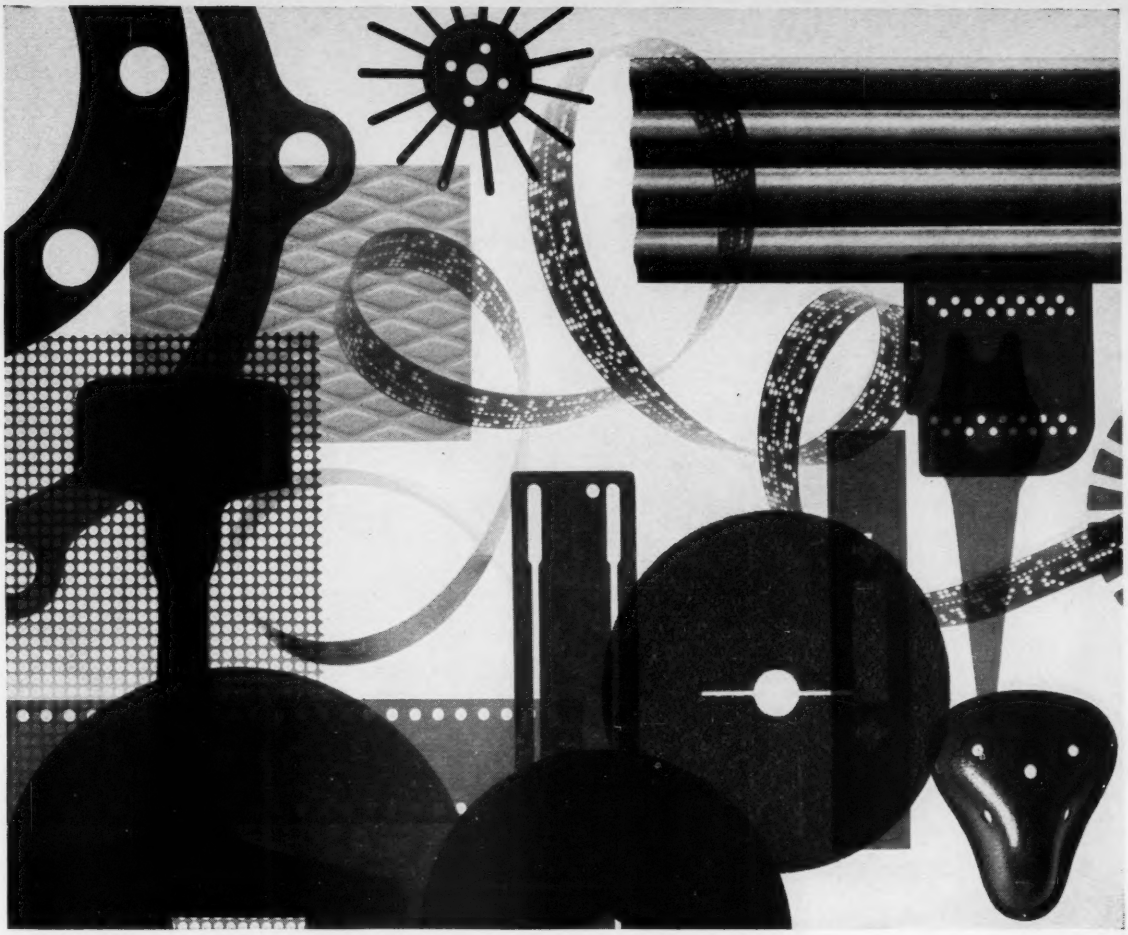

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What is Vulcanized Fibre? A tough, dense cellulosic plastic. As track insulation, thousands of tons of Vulcanized Fibre are now absorbing the steady beating of trains passing over. Has the highest arc resistance of any material known; is a class "A" electrical insulation. Low thermal conductivity, high resiliency, great shock and abrasive resistance. Shrugs off oil, gasoline, most solvents. A most un-ordinary plastic. Weighing but half as much as aluminium, Vulcanized Fibre is one of the strongest of materials for its weight.

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There are 16 standard and many special grades, among them "Pyronil", which is fire-resistant. You may find precisely the properties needed to make your product a better buy. There's a free sample kit waiting for you at the nearest National sales office. Or write directly, Dept N8, Toronto, Ontario.

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Call the National Sales Office near you. It's a direct line to single-source help on your current materials problem.

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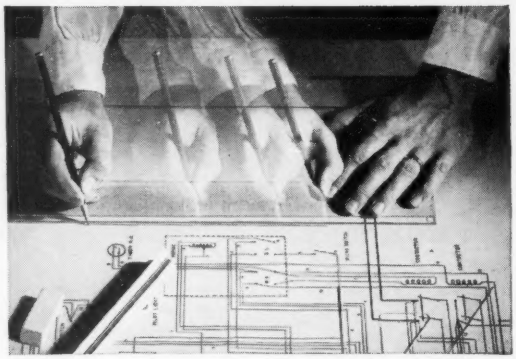
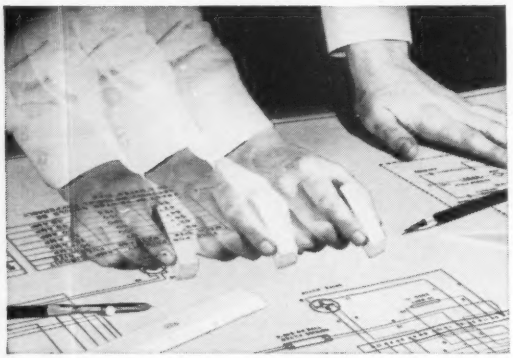
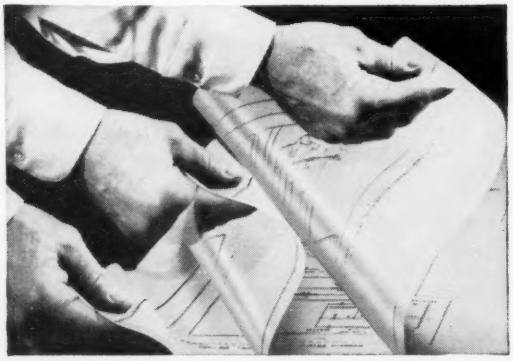


A single word explains it: *consistency.* ■ CRONAFLEX is the *only* drafting film made entirely by the same manufacturer . . . from start to finish. ■ Du Pont makes both the rugged "Cronar"* polyester base *and* the fine matte tooth surface . . . maintains the same rigid standards of quality control over the all-important methods by which they are combined. ■ Result: *consistent* uniformity, *consistent* excellence found in no other drafting film. Every sheet of CRONAFLEX gives you the same outstanding pencil acceptance, the same erasability, the same superior covering power and consistent line density *every* time you use it . . . day in, day out. ■ CRONAFLEX Drafting Film is made .004" thick to give it the body it needs for easy drafting, easy filing. In addition, it has optimum transparency for high-quality reproduction; comes matted one side or two in rolls or sheets. ■ Find out for yourself why engineers and draftsmen in growing numbers say CRONAFLEX gives them the best drafting surface available. For more information, contact your local Du Pont Photo Products sales office, or write: Du Pont of Canada Limited, Photo Products, 85 Eglinton Avenue East, Toronto 12, Ontario.





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5 REASONS FOR SPECIFYING U.E. INDICATING TEMPERATURE CONTROLS

✱ **HIGH SENSITIVITY...** on-off differentials from ± .5° F with excellent repeatability

✱ **LOW COST . . .** list prices from $35.00 with generous quantity discounts

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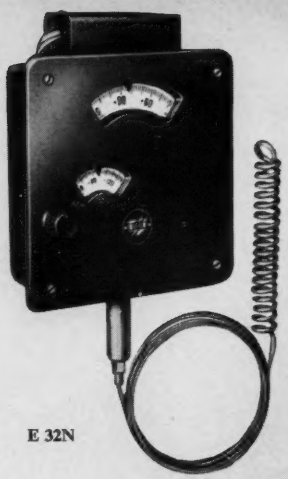
✱ **GREATER VERSATILITY...** many styles, ranges, sensing elements and switch characteristics permit hundreds of "custom-built" combinations

ALL PURPOSE

-150° to +650° F

A sensitive wide range unit with control point accuracy equivalent to individually calibrated instruments. 10" rotating scale permits unusual readability and close settings. Available with dual switches for controlling two independent circuits.



E 32N

E 36N

LOW COST... (800 Series) -150° to +650° F
Short dial spans of 50 to 200° F permit compact design only slightly higher in price than non-indicating controls. Available with dual switches.

HIGH TEMPERATURE . . . (900 Series) 0° to +1000°F
A NEW high temperature series with rugged stainless steel mercury filled thermal systems.

For the USUAL or UNUSUAL application, United Electric offers quality controls at economical prices.

E 65N

SPACE SAVING... -150° to +650° F
Skeleton design permits direct incorporation into equipment – saving cost of enclosure. Many models with dial spans of 50 to 200°F. Available with face plate for panel mounting.

E45N

SPECIAL PURPOSE... -150° to +1000°F
Shown here is a typical Special Purpose control used on medical equipment, such as baby incubators, etc. WHAT IS YOUR REQUIREMENT? Chances are one of our standard controls will satisfy your needs. If not, we'll put our 30 years' experience to work for you on special designs.

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Write TODAY for complete specifications and price information on U. E. Indicating Temperature Controls, Attention Dept. W.

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COMPANY_____

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Design Notes on Fluid Power

RELEASE No. 12: — HOW SERVO VALVES CAN HELP YOU.

When one of the solenoids on a four-way valve is energized, the valve spool moves completely across from neutral to an operating position; one of the tests of a good valve is a **low** pressure drop through the valve. An electro-hydraulic servo valve is, at first glance, very similar to a three-position solenoid four-way; functionally, the main difference is that the spool can be positioned so as to allow more or less flow through the valve, depending on the intensity of the electrical signal. Thus the servo valve must be able to create a **high** pressure drop, in order to act as a flow control.

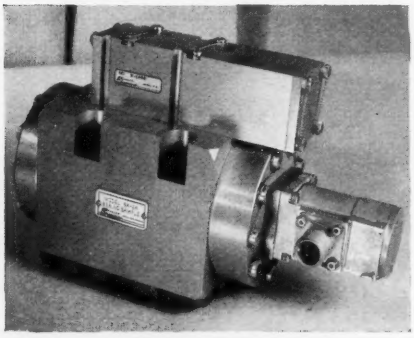
Instead of a solenoid, the actuating electrical element is called a force-motor, and it is very sensitive, responding to a current in the order of 25 milliamperes. In some systems, a constant signal of say 20 ma. impressed on each of the two force-motors, keeps the valve spool centered, thus locking the actuating device (cylinder or fluid motor). As the relative value of the signals is varied, the spool shifts in proportion to the differential current, allowing more and more hydraulic flow as the differential increases. In other systems, the valve will be centered with zero signal to each force-motor. The actuator must incorporate a feedback device which gradually reduces the differential as the demands of the system are being met, thus re-centering the valve.

As you might expect, one can only explain an electro-hydraulic servo-mechanism in two paragraphs by resorting to a gross over-simplification. The important things to remember are what the servo valve can do for you.

Since it can convert a very small electrical signal into a proportional flow of oil at high pressure, it is ideal for any automatic control where heavy loads are involved; position control, such as punching holes in structural steel, automatic cut-off of sheet material at high velocity, machine tool control, synchronization of linear or rotary operations, speed control, relative to fixed input or variable input.

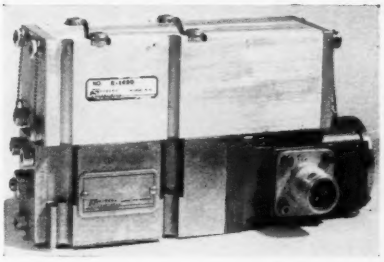
An operation can be programmed using punched cards or tape; control can vary as a function of time, or of other processes, or of a combination of these.

This is the last in our current series of Design Notes. If you would like to receive all twelve issues for your files or for educational purposes, please circle our ad. number. If more than one set is wanted, please write to our Montreal office stating your requirements. We hope our little notes have been helpful.

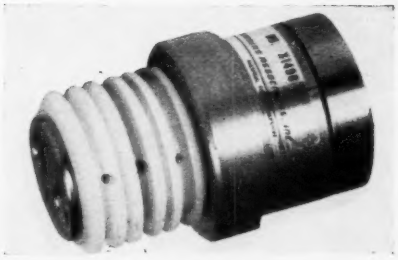


The Sanders SV-324 is rated at 0 to 45 gpm. A still larger valve, SV-522 (not illustrated), is rated up to 200 gpm and is similar to the valve used on the guidance system of nuclear-powered submarines.

Sanders Model SV-219 servo valve, rated for 3000 psi system pressure, to deliver 0 to 8.5 gpm at 1000 psi pressure drop.



The Sanders MINIVALVE, SV-128, 0 to 1.5 gpm. All Sanders valves are two-stage, with internal force feedback between first and second stage.



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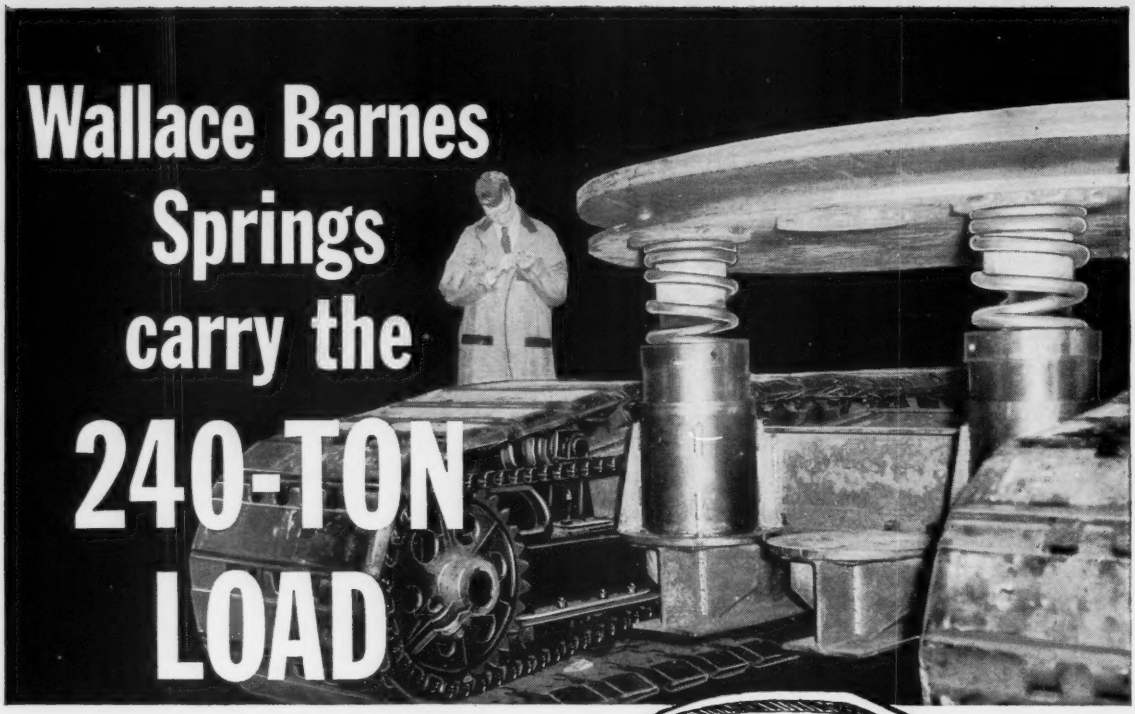
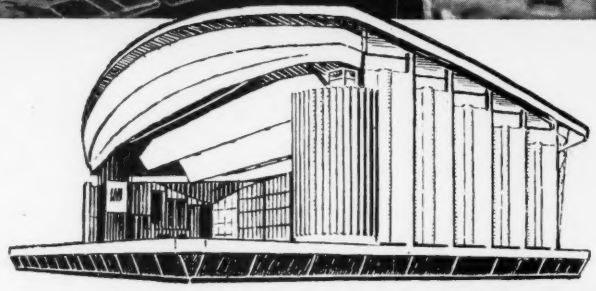
Wallace Barnes Springs carry the 240-TON LOAD of the CNE MOVABLE STAGE





The Canadian National Exhibition was faced with the problem of providing football facilities for the Toronto Argonauts immediately before and after the annual Grandstand Show, without the week-long delay of building and dismantling the stage.

Would a movable stage solve the problem? (The stage is 160 ft. long, 80 ft. wide, 40 ft. high, and weighs 240 tons!)

Consulting engineers designed a stage that could be mounted on electrically powered crawler tractors to transport it on and off the field.

MOVING STAGE "FLOATS" ON SPRINGS

To protect complex lighting equipment and elaborate mechanisms, giant springs were designed to support the 240 ton load while being moved. Wallace Barnes constructed huge, 90 lb. hot wound compression springs to cushion the stage during the 400 ft., 5 minute move. 44 of these springs were required to distribute the load throughout the 12,800 sq. ft. base. Trial runs proved that the stage could be moved smoothly without undue jarring or stress.

This is the first stage of its kind in the world and CNE officials are confident that it will pay its way by allowing football and other field activities to take place immediately before and after the annual 3-week Grandstand Show.

The Wallace Barnes Company Ltd.

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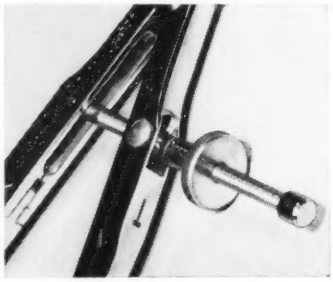
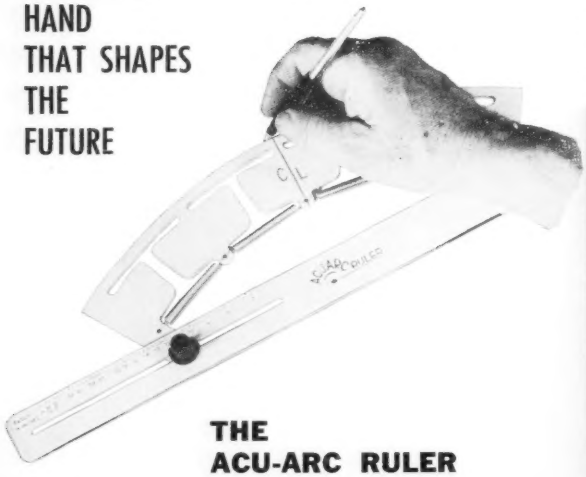
ALPHA QUICK-SET BOW One of the most useful single instruments you can own. With the Alpha Quick-Set Giant Bow you simply squeeze and it is set at the radius you want. Use conventional ratchet for fine adjustment.



ALPHA

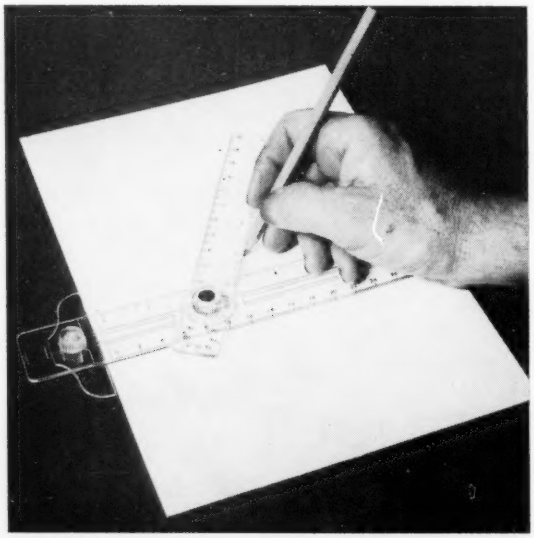
HELPS THE HAND THAT SHAPES THE FUTURE



POLYANGLE

The Polyangle is a precision instrument designed to adjust to a pad for fast yet accurate sketching or drawing to scale. Compact in its plastic carrying case, engineers and architects find the Polyangle ideal in the field or at their desks.

The main scale slides to provide parallel horizontal lines and the spring-loaded angle arm can be snapped into positions of 30 - 45 - 60 - 90 - 120 - 135 - 150 degrees either above or below the horizontal. The arm sets to angles quickly, remains in position and can be moved horizontally while maintaining angle setting.



THE ACU-ARC RULER

The revolutionary new Acu-Arc ruler is designed to provide the draftsman with a straightforward and accurate method of drawing arcs of circles of any radius from 7" to 200" or more. No other single instrument is available to draw arcs of circles of such a large range of radii. Nor is there any other instrument available to draw arcs of large circles as quickly, easily and accurately.

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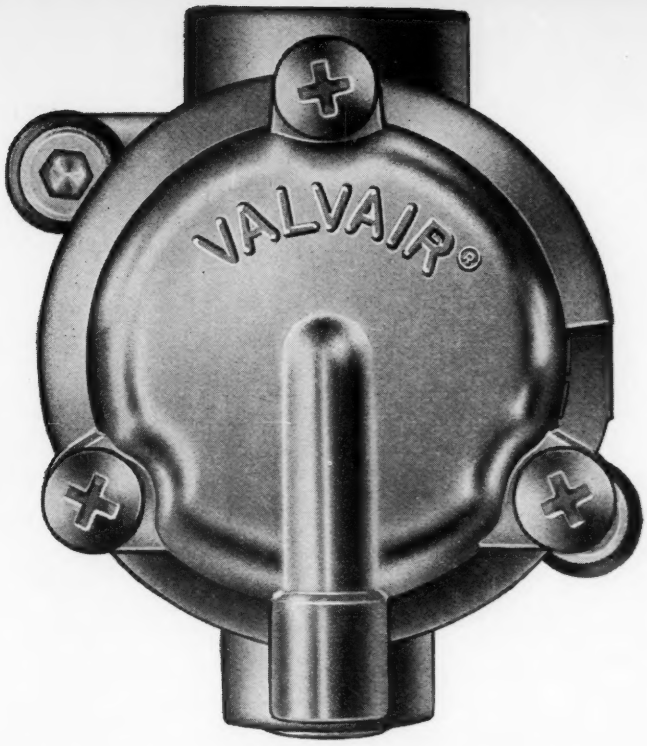

here's a pilot you can trust!

In hundreds of thousands of heavy-duty industrial air valve applications, Valvair pilots have proved their ability to provide trouble-free performance and multi-million cycle dependability. They offer maximum simplicity, with but two moving parts . . . flow-through cooling, with air passing through the center of the pilot for heat dissipation during rapid cycling . . . low current draw to prevent overheating, even when continuously energized for hours, days or weeks! And, Valvair pilot coils are potted in resin for moisture-resistance . . . are guaranteed against burn-out for the life of the valve.

What's more, Valvair's pilot is truly universal . . . interchangeable for use on any Speed King® valve. There's no need to stock a confusing quantity of different pilot assemblies or a myriad of parts. So, stockroom and in-service maintenance problems are minimized.

Pilot performance is vital to the dependable operation of the machinery you design, build or use. Your nearby Bellows-Valvair Technical Representative can show you why Valvair's pilot is the one you can trust.

For more information, write for Bulletin FL-61. Address Bellows-Valvair, Ltd., Toronto 18, Ontario, Dept. DE-861.

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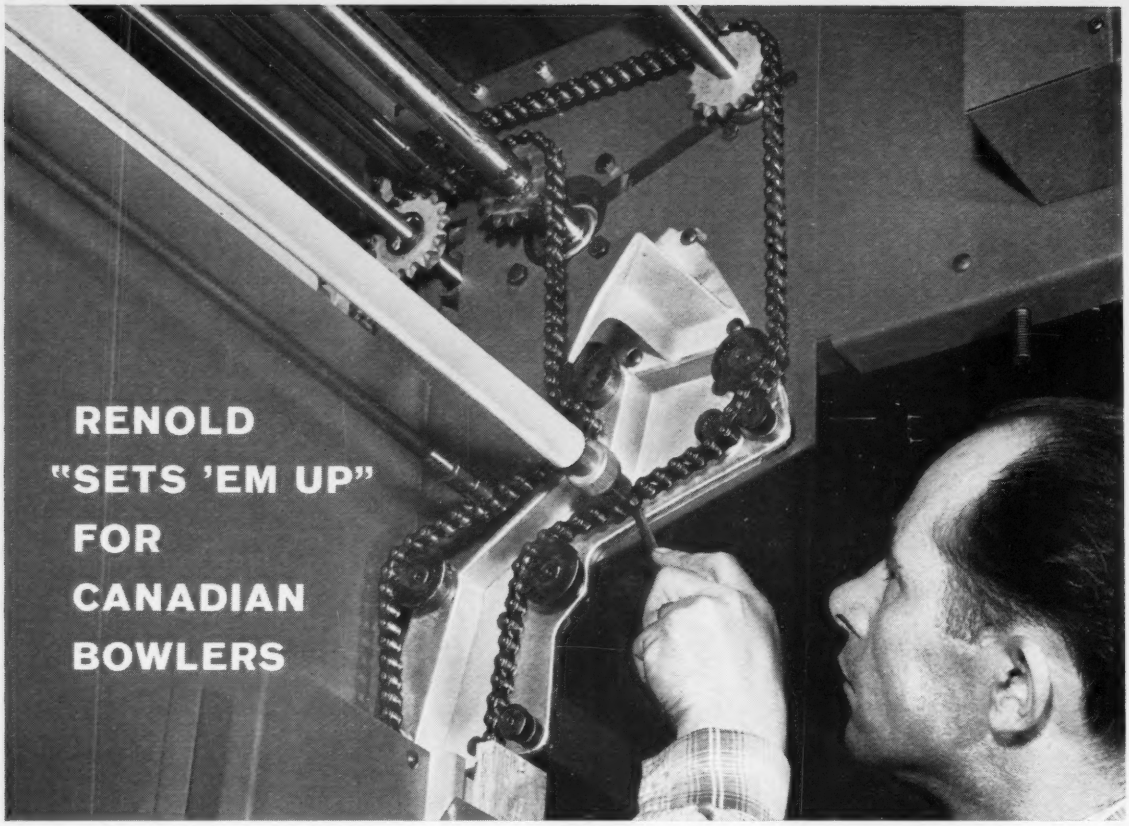

In the photograph above, an automatic pin setting machine is being fitted with Renold precision Roller Chain. The machine, built by Philips Electronics Industries Ltd., of Leaside, Toronto, is similar to the hundreds now in use that have helped raise bowling to a major popular sport in Canada.

In selecting the exact type and size of chain for the job, and the most effective method of applying it, Philips and Renold worked closely together—with extremely satisfactory results.

Because in the bowling field any breakdown immediately starts costing the proprietor money, strength and reliability *in every link* were vital. So there were two main reasons why Renold chain was selected—in addition to the price advantage. Breaking load of the Renold product —#112046, ½" pitch—is 3000 lbs., against only 2000 lbs., for the nearest alternative. Secondly, Renold chain incorporates a larger bearing pin, resulting in greater strength at the mounting of the conveyor bars — precisely where greater strength is needed.

The unique advantages of Renold Roller Chain, and of close co-operation with qualified help, have resulted in important savings and greater efficiency in many different fields. Consult with Renold on *your* power transmission applications—any time.

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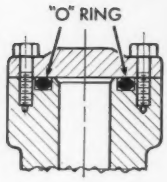

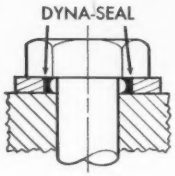

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Precision "O" Rings are engineered specifically for your product! They meet all military and commercial specifications. There's a size and compound to meet YOUR requirements. Write for data sheets to...

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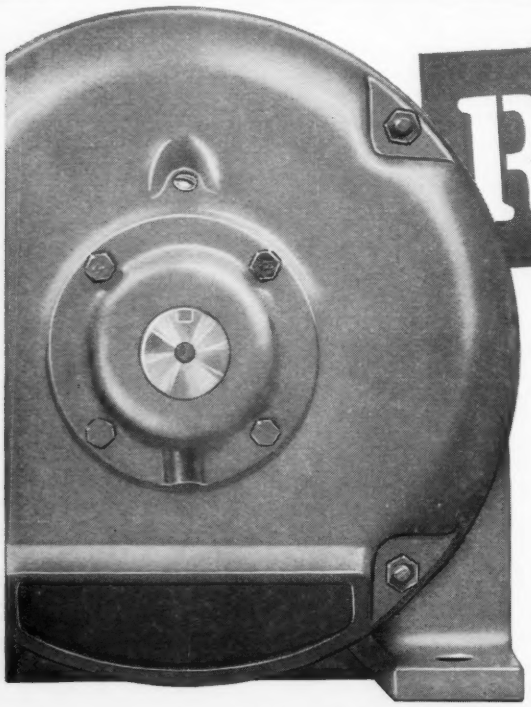

RUGGED

256U Wagner

Standard Protected *polyphase motor*

The heavy, solidly built frame of these famous Wagner polyphase motors is just one factor in their long dependable life. The transverse greasing system—exclusively Wagner—removes "old" grease, forces in new. The cooling fan and rotor is *ONE PIECE*—statically and dynamically balanced. Windings are given added life with special Harvel moisture proofing varnish.

And what about performance? Wagner engineers have built in excellent torque characteristics . . . and full load speeds are good (typically between 1750 and 1765) and these motors run COOL! You cannot buy a better motor!

Wagner Motors are designed, engineered and manufactured in Canada

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STANDARD TUBE

EXTENDS ALUMINUM SERVICE

Through arrangements recently concluded, Standard Tube and T.I. Limited is now in a position to offer the products of James Booth Aluminium Limited of Great Britain and is thereby extending considerably the services it provides in the field of aluminum and aluminum alloys including extruded, rolled and forged products.

Booth has long been in a prominent position in the aluminum field, particularly in the supply of high quality alloys for aircraft, shipbuilding, etc., and is currently engaged in a major enlargement of its facilities to afford complete coverage.

Standard Tube's "speed ship" service will operate from key warehouse locations across Canada where larger stocks of aluminum products will be maintained. Standard Tube's country-wide network of warehouses and sales offices will also provide excellent service on mill quantities of a wide range of aluminum products from foil stock to the largest plate manufactured.

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AND T. I. LIMITED

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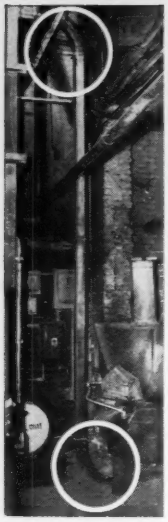

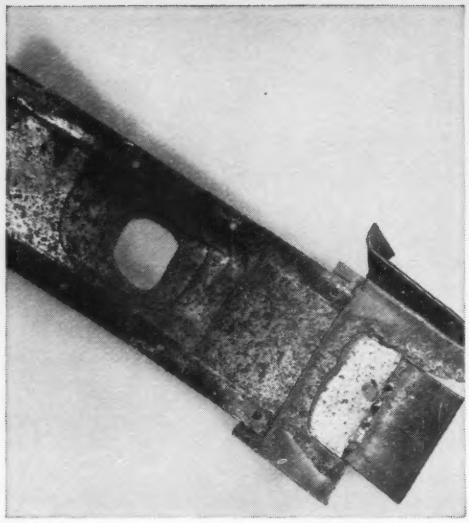

175° F. sand, being blown to storage, regularly wore through special abrasion-resistant alloy steel wear plates at duct elbows in only 2 months.

Abrasive sand finally gnawed through ADIPRENE* urethane rubber liner in elbows – but it took 6 months.

Foundry finds ADIPRENE* outwears steel 3 to 1

This interesting application shows dramatically how tough ADIPRENE urethane rubber really is. And designers are finding that this outstanding abrasion resistance . . . plus excellent load bearing capacity and low temperature resistance . . . is the solution to many design problems.

For example, industrial wheels made of ADIPRENE are outlasting those made of ordinary rubber 5 to 1. A leading auto manufacturer is using ADIPRENE for longer lasting ball joint seals. Manufacturers in both civilian and defense industries use ADIPRENE for impact, shock and abrasion resistant mounts, bumpers, bushings, suspension straps. A metalworking company is employing ADIPRENE as a female stamping die . . . finds that it survives 50,000 impacts as compared to only 400 for ordinary rubber. From "potting" to pulleys . . . from shoe heels to shock resistant grinding wheels . . . with its unique set of properties, ADIPRENE can help you design better, longer lasting new products. For more information about ADIPRENE write Du Pont of Canada Limited, Elastomers, 85 Eglinton Avenue East, Toronto 12, Ontario.

DU PONT CANADA

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NOW for industry . . .

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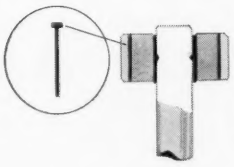
STRUCTURAL ADHESIVES

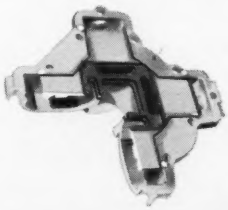
This amazing new "chemical welding" process enables you to fabricate without welds or rivets, solve design problems, and reduce parts assembly costs

Adhesive bonding of thin metal aircraft skins, metal braces, stiffeners and other parts was pioneered by the aircraft industry to develop stronger yet lighter, faster, higher flying planes. Certainly, if "Scotch-weld" Structural Adhesives are used to advantage in assembling multi-million dollar high-speed aircraft, they can also be used to advantage in load-bearing applications in many other industries. This modern, high strength method of joining metals, reinforced plastics and other materials, permits improved design and production techniques, cuts costs and offers many unique benefits . . . smoother contours . . . lighter gauge materials . . . reduced inspection . . . unusual combinations of materials, and so forth. Already, "Scotch-weld" Structural Adhesives have solved design and production problems for manufacturers of appliances, metal shipping containers, pneumatic tools, pumps, motors, scaffolding and many other items. They may be able to do the same for you. Mail the coupon and let us show you how.



Adhesive bonding small pinion gears to rotor shafts provided savings of $56.37 per thousand by reducing rejects, and eliminating secondary operations and the necessity for 100% inspection.

A pump manufacturer reduced rejection rates from a high of 25% to nearly zero by adhesive bonding three separate die castings to form a single part.



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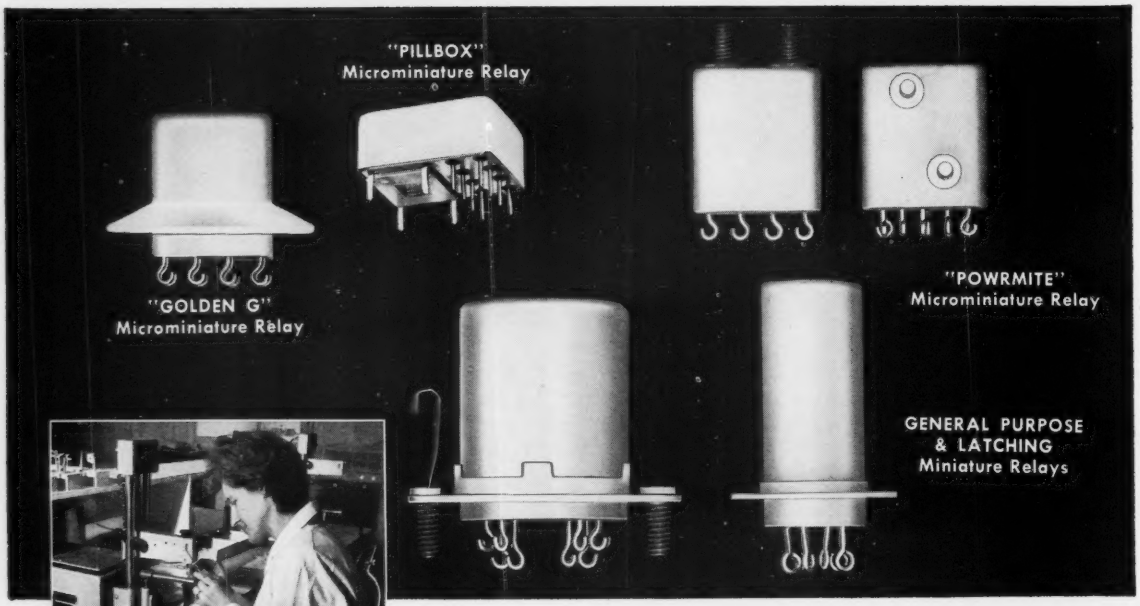
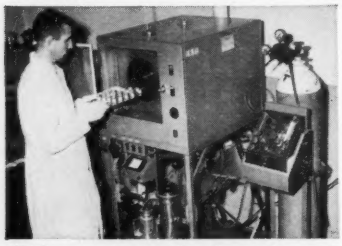
PREMIUM QUALITY MICRO-MINIATURE RELAY

This completely gold-plated, hermetically sealed micro-miniature relay will meet 50-g's vibration to 3000 cps and 250-g's shock. Tested for over 6,000 operations at 125°C, 25°C and —65°C, under dry circuit conditions prior to shipment.

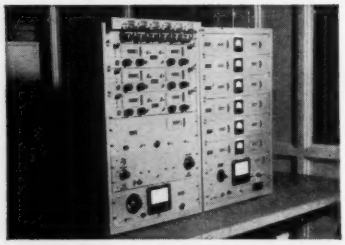
RELAYS* by MARSLAND



Contact welding with precision tool electrodes.



High vacuum oven for degassing and backfilling with inert gas.



Monitoring equipment for life and low level *miss* testing.

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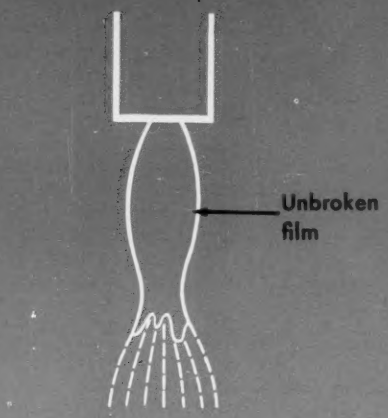
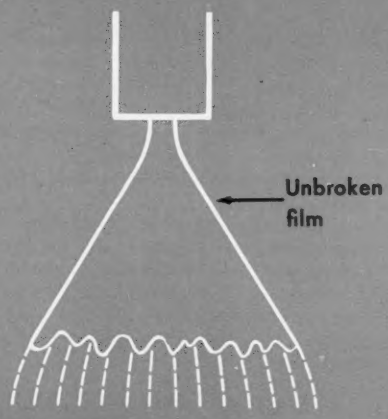
Simplified specs for spray nozzles

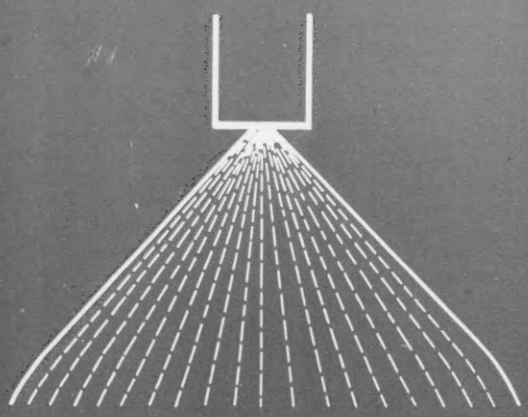
Getting the optimum mileage out of an often neglected component is explained by K. W. Jay, P.Eng., of Orenda Engines Ltd.



"Bubble" stage
very low flow and pressure



"Tulip" stage
Low flow and pressure



Full spray
Normal flow and pressure

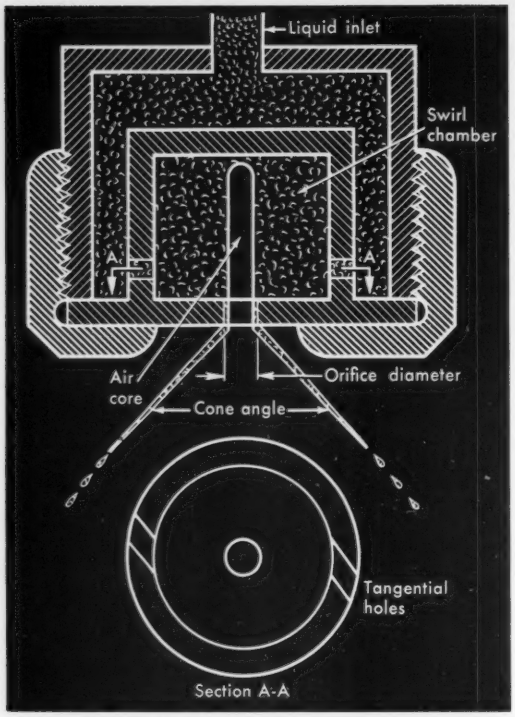
In the design of certain types of industrial equipment such as oil burning furnaces, agricultural sprayers and some chemical process apparatus, a device known as a swirl type spray nozzle finds a wide application. This type of nozzle sprays liquid in a fine mist for processes such as combustion, homogenous insecticide distribution and various manufacturing operations. One quite specialized use is for fuel injection in aircraft gas turbine engines and much of the research done during the past twenty years has been in this connection.

The main purpose for using a spray nozzle is to provide a cone of finely atomized mist. If we consider its use in an oil burning furnace, an even, homogenous mass of fuel droplets is necessary for high efficiency combustion. The qualities of the spray with which we are most concerned are droplet size, cone angle and general distribution of the spray, usually called spray patternation. Before defining and describing tests for these factors, let's take a look at a cross section of a representative nozzle and examine the action that takes place *(see sketch on page 28)*.

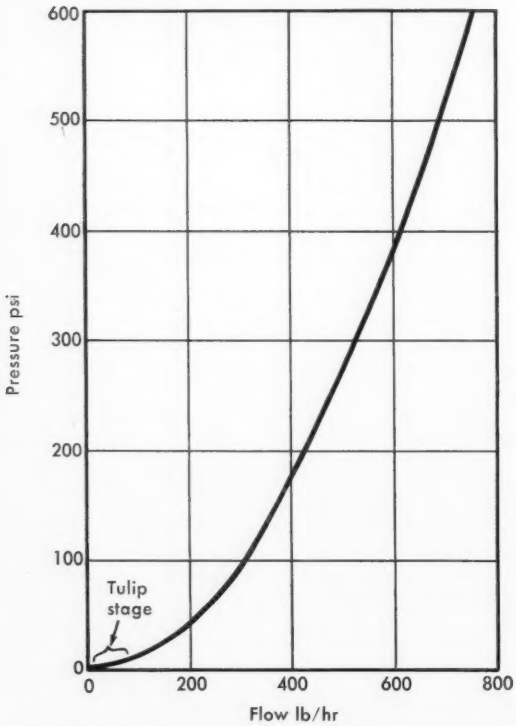
Liquid enters the swirl chamber through the tangential holes. There are usually two or more of these. The liquid rotates with a free vortex action in the swirl chamber because of the velocity and direction given by the tangential holes. As the liquid spins toward the outlet orifice its rotational velocity increases until it exits from the orifice and becomes a conical spray.

Note that an air core is present at the orifice and up into the swirl chamber. This means that the liquid is discharged from an annulus of very definite thickness. As the distance from the orifice increases, the annulus thickness decreases until the liquid surface tension can no longer retain it as a sheet. It therefore finally breaks into strings and then droplets.

Breaking up a liquid in this manner requires energy, and here the energy is supplied by the liquid pressure drop across the assembly. The distance from the nozzle at which the liquid sheet breaks into droplets is therefore a function of pump pressure. At very low pressures there is virtually no energy present to atomize the liquid and the film forms a bubble shape until it falls away in coarse drops. Over the working range of pressures



Schematic diagram of cross-section of a representative nozzle.



A typical nozzle calibration curve.

and flows a full spray of very fine drops is produced and it is this type of action that results in the swirl type spray nozzle being such a useful device.

Nozzle rating

The pressure flow relationship of a swirl type spray nozzle is the same as that of a plain orifice — flow increases as the square root of the pressure, or $Q/\sqrt{P}=$ a constant. At least one segment of British industry uses this relationship to rate nozzles. The rating is called the flow number, and for any single liquid the definition is:

$$\text{flow number} = \frac{\text{Imperial gallons/hour}}{\sqrt{\text{pressure drop in psi}}}$$

American practice for furnace nozzles is to specify the U. S. gallons at 100 psi. The next time you have your furnace apart, if you examine the nozzle, it may have stamped on it 1.00-80 deg., which means that it passes 1 USgph at 100 psi and has a cone angle of 80 deg.

Droplet size

Droplet size is very important for combustion work since particles of too large a diameter result in smoky and inefficient burning. A properly designed nozzle working at its rated pressure produces droplets of 120 to 150 microns in diameter. The drops emerging from the 'tulip' type spray are often referred to as 'rain' and are larger than 200 microns. (One micron is approximately .00004 inches.)

There are several methods of determining droplet size. One early method consisted of spraying wax heated to the correct viscosity, collecting the spray in water, and measuring the resulting solid particles.

Photographic methods have also been used. The spray is photographed with high speed equipment and the droplets on the photograph are measured.

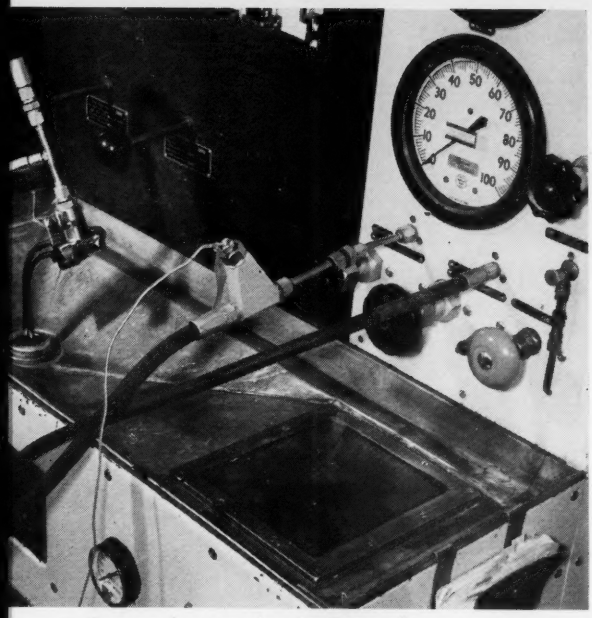
Patternation tests

Patternation may be defined as a measurement of the distribution of droplets throughout the spray. If there is a large concentration of droplets in any one segment of the spray, a condition of streakiness is present, and it is apparent that under such circumstances undesirable performance would occur for most nozzle applications.

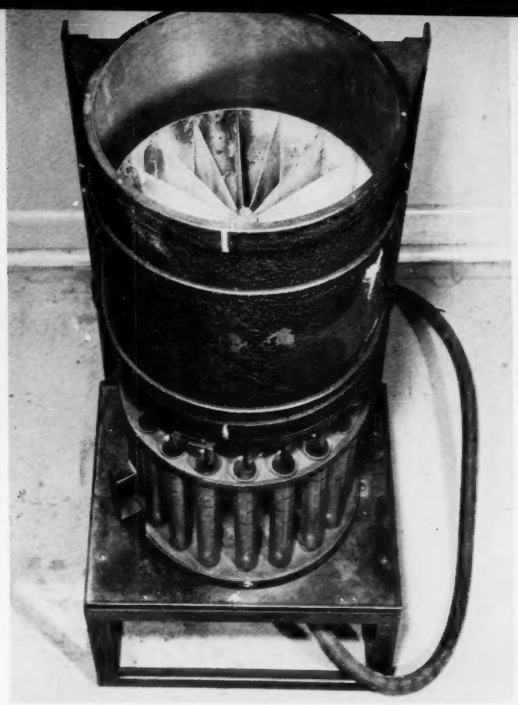
The accompanying picture illustrates one type of test rig that is used to measure patternation. Fuel from the nozzle under test is sprayed into eighteen sectors, and then drained via short tubes to eighteen graduated receptacles. When any one receptacle is filled to 75 cc the fuel is shut off, and the level in the vessel having the least amount of fuel is read. If it were say 60 cc, the patternation of the nozzle would be designated as 75/60. An actual industrial furnace nozzle checked by the author's company gave a patternation of 75/56.

For most applications of swirl type spray nozzles the designer is interested in the angle of spray. An arrangement is sketched that does an excellent job of measuring cone angle. The system of elements — the light, fuel spray, lens, mirror and ground glass, results in a sharp image of the spray on the ground glass, from which the cone angle is easily measured with a protractor. Another less sophisticated method is to clamp a protractor behind the spray, and by careful sighting, estimate as nearly as possible the actual angle.

Cone angle shifts somewhat with the pressure drop



Cone angle measuring rig. Rectangle at right contains ground glass for viewing and measuring angle of spray.



View of patternation rig showing sectors and some of the eighteen receptacles.

across the nozzle. A nominal 90 deg. furnace nozzle measured 85 deg. at 50 psi, and 92 deg. at 400 psi.

Nozzle construction and selection

There are many designs of swirl type spray nozzles. Shown is a diagram of a typical furnace nozzle. Swirl is imparted to the fuel by the tangential slots. The piece in which these slots are machined is steel, and it is floating in its retaining member to ensure proper seating on the steel insert containing the final orifice.

In the design of spraying equipment there are a number of requirements to be met. The following are the usual ones

- Flow range
- Pressure available
- Cone angle
- Patternation
- Droplet size

The flow range and available pump pressure go together. The lowest flow must as a rule be a full spray rather than a 'tulip' and hence the nozzle must be selected for this condition to begin with.

If the maximum flow is greater than about eight times the minimum flow, pump pressures become relatively high, and if the liquid is of low viscosity, pump life will suffer. In such a case, the simple swirl type nozzle described in this article is not adequate, and other types such as spill and dual orifice must be used to extend the range.

In deciding upon the correct cone angle it must be remembered that specified ratings in catalogs are nominal, and that tests are usually necessary to determine the actual angle at all flows.

Patternation is very seldom mentioned for industrial nozzles and again tests are necessary to get a measure of comparison for different nozzles.

Droplet size will vary with flow and viscosity. Catalog information is usually scarce so that some form of laboratory testing is necessary if this parameter is important. ★

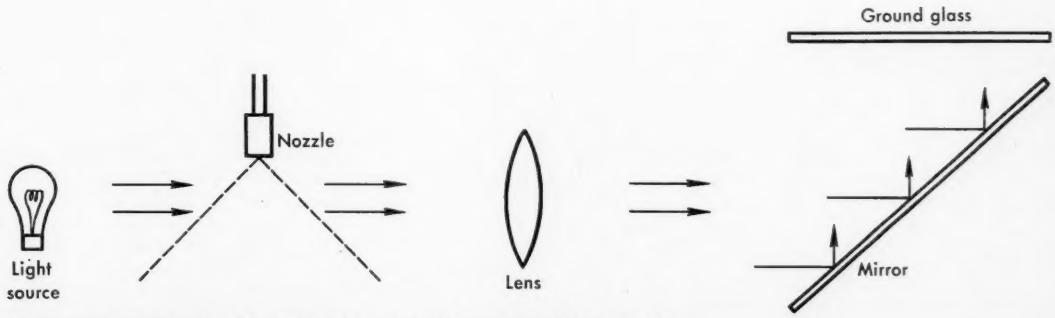


Diagram of equipment (above left) for measuring cone angle of nozzle.

No. 2 of a series

Do you know your hydraulic fluids?

Continuing Harold Yarnell's series which began in DE's July issue . . . the design procedures required for converting to fire-resistant fluids.

Due to the physical properties of fire resistant fluids, certain preparatory steps should be taken when converting a hydraulic system for use with fire resistant fluids. For instance, fire resistant fluids have a heavier specific gravity, which will cause the pump to cavitate if the strainer is not changed. Some have a solvent action, which will remove paint and sludges. These will require continuous filtration to prevent build-up of contaminants and malfunctioning of valves. Others are not compatible with standard seals and packers. Earlier non-water base fire resistant fluids have a lower viscosity index than petroleum oils, and therefore have more viscosity fluctuation with temperature change. Newer non-water base fire resistant fluids have a high viscosity index and are more stable with temperature changes. A properly designed system, having rigid temperature controls and means of obtaining self-purging of foreign substances, should give satisfactory service with a minimum of maintenance.

Oil in water emulsions can be used with the standard components in most systems designed for petroleum oil, after the pump inlet strainers have been changed. Water and glycol mixtures will need larger capacity pump inlet strainers, and all painted equipment as well as pipe dope will have to be checked for compatibility. Phosphate-ester type fluids will need compatible seals as well as proper strainers, paint, and pipe dope.

Reservoirs are usually painted inside. The paint acts as a sealer to minimize the effects of condensation. All of the fire resistant fluids, except oil in water emulsions, tend to soften and dissolve many of the industrial paints now used. Fire resistant fluids also act as a detergent on gums and other deposits. Non-compatible paints and sealers must be removed. Remove all paint from interior surfaces by either sand blasting or steam. If need be, use a paint solvent and scrape. Wipe clean with a lint free cloth.

Special paints must be used

Once the paint or other deposit material has been removed from the interior surfaces of the equipment, it need not necessarily be replaced. Most of the fluids are non-corrosive and provide the necessary protective coating for the various surfaces, except the interior surfaces of the reservoir above fluid level. Rust will form on this portion of the reservoir. Care should be taken to select a sealer which will not break down due to the chemical action of the hydraulic fluid. Special paints have been developed for each of the several fire resistant fluids and should be used to prevent oxidation on interior surfaces.

When using an oil in water emulsion type fluid, the paint need not be removed. The paint and sealers used for petroleum hydraulic reservoirs are compatible with the emulsion type fluids.

When fire resistant fluids were first introduced, the plasticizing characteristic of paint was of great concern, since many equipment manufacturers painted the inside of their fluid reservoirs and hydraulic components. It was felt that this removed material could cause pump and valve malfunctioning.

Fortunately, field experience proved this plasticizing effect on paints was not harmful to hydraulic system performance. For the most part, the fire resistant fluids plasticized the paints to the point where they were completely fluid and were readily pumpable. However, it is suggested that after a system has been converted to a fire resistant fluid, a by-pass filter be connected to the system to pick up any paint particles or other residual material that may not have been completely dissolved or removed by the regular system suction line strainer.

Normally, reservoirs are 2.5 to 3 times the pump capacity. This gives the foreign elements an opportunity to settle out in the reservoir before the fluid is again recirculated. This also gives the fluid time to de-foam and partially cool through radiation on the sides of the reservoir. The addition of a permanent magnet near the suction inlet will aid in the removal of foreign metallic particles, such as broken pipe threads and worn parts.

Should strainers be changed?

Strainers on pump inlet suction lines are normally equipped with a 100 mesh suction strainer having a capacity (measured in terms of 225 S.U.S. petroleum oil at 100 F) of equal to about 1.5 times the rated pump output. As a result of the increased specific gravity, an excessive pressure drop would occur across a screen of this capacity with resultant pump cavitation and serious damage.

Typical recommendations by pump manufacturers are a maximum permissible vacuum at the pump inlet of 5 psi (10 inches of mercury) for vane type pumps and of 7.5 psi (15 inches of mercury) for gear type pumps. A vacuum gauge on the pump inlet will indicate the condition and cleanliness of the strainer. As the gauge reading increases the strainer becomes more and more clogged.

Tests have indicated that systems converted to a fire resistant fluid will give better performance when the strainer has been changed to one giving more than four times the rated pump capacity and having no finer than 60 mesh screen. This will permit unrestricted suction flow.

Filters generally use a finer screening element than do strainers. Although the composition of these screening elements varies considerably, depending on the

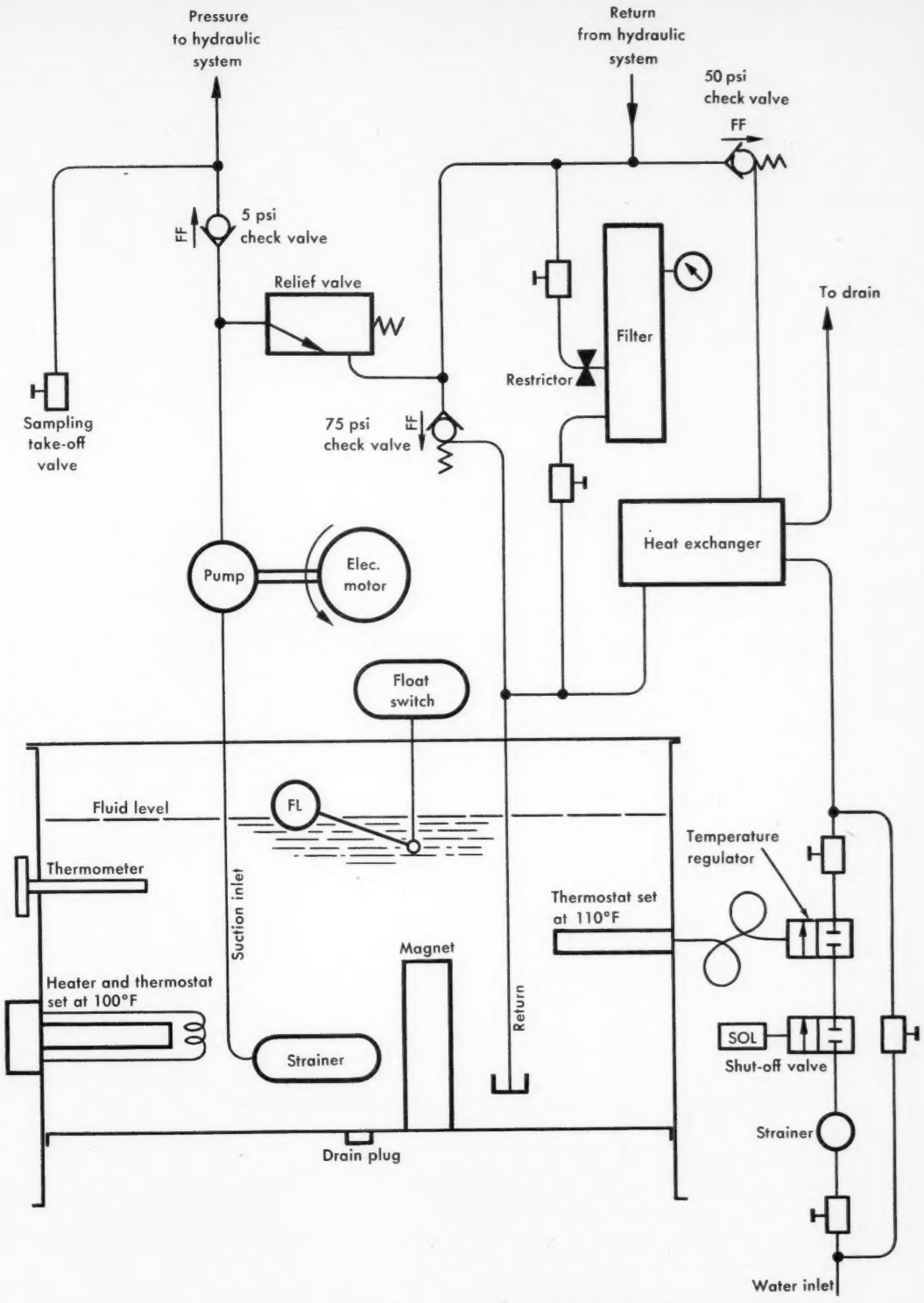


Diagram of equipment for fire-resistant fluid installation.

manufacturer, the more common absorptive type media used are resin impregnated paper, wood cellulose, Fuller's earth or activated clay. Filters employing Fuller's earth or activated clay should not be used with additive type hydraulic fluids. Such filters will remove the additives as well as the impurities. The only non-additive type fire resistant fluids are the pure phosphate-ester fluids. Other filter media, classified as non-absorptive, are filter elements made from 200 to 300 mesh wire screen, or edge-plate, or knife edge type. Any of these will insure minimum solid contaminant.

What about proportional filters?

It is nearly always possible to provide by-pass or proportional filtration, whereas, it is not always practical to provide full-flow filtration. A full-flow type filter provides a greater amount of screening action for any given operating time, but it offers considerable resistance to flow when it becomes dirty. Proportional filters, by the continuous recirculation of the fluid through the system, will eventually cause all of the fluid to pass through the filter cartridge.

Satisfactory proportional filtration can be accomplished by inserting a filter in a by-pass section in the return line. A restriction orifice in the filter inlet will meter the flow and a 50 pound resistance check valve in the main return line will assure ample pressure to feed the filter through the restrictor. Fifty psi pressure against a 1/16 in. diameter orifice will pass approximately 1/2 gpm. Since it is only necessary to filter the system once in an eight hour shift, a 1/16 in. diameter orifice will usually be found to be too large. However, a smaller orifice may become plugged.

A gauge mounted on the filter case will indicate the cleanliness of the filter cartridge. As the gauge reading goes up, the cartridge is becoming dirtier and thus less efficient. Internal pressures within the filter should not exceed 5 psi with new clean cartridges. In no case should the internal pressure exceed 50 psi. Excessive pressures may damage the filter.

When using proportional filters, the addition of shutoff valves on both inlet and outlet ports will permit isolation of the filter unit. Filter cartridges can thus be replaced without stoppage of hydraulic system.

Heaters and coolers are frequently omitted on hydraulic systems. However, with temperature change the viscosity of the non-water base fire resistant fluids will fluctuate more rapidly than that of oil. The addition of thermostatically controlled heaters for minimum temperatures, as well as coolers for maximum temperatures, will give a more constant viscosity range and better fluid control. Rigid temperature control is necessary for better over-all operating efficiency and longer service life to the fluid itself. This applies to oil as well as fire resistant fluids.

Immersion heaters with a built-in thermostat installed in the reservoir, are the accepted method of preheating a hydraulic fluid. These are constructed from a helical coil of nickel chromium resistance wire embedded in refractory material and enclosed in a metal case. Connections are brought out to terminals.

The immersion heaters are rated in kilowatts and are specified on the basis of the amount of fluid to be heated. In calculating the heat losses through the sides of the reservoir, a loss of 5 watts per square foot at 70 F is assured. A general rule of thumb for estimating immersion heaters is that one kilowatt will heat 100 gallons of fluid 10 degrees in one hour.

In addition to considering the heat capacity of the immersion heaters, the watt density or amount of heat generated per square inch of heater surface area is an important consideration in preventing burning of the fluid. The watt density should be limited to 20 watts per square inch for circulating fluids, and 15 watts per square inch for static fluids. Watt densities higher than these cause a build-up of carbon on the heater. This decreases its heat transfer ability and eventually results in burnout of the heater and breakdown of the fluid.

Where to place heaters

The heaters should be mounted as close to the bottom of the reservoir as possible, leaving only enough room to prevent sludge from coming in contact with them. In some installations this may be difficult because of interference with valves and piping. One solution is to bend the immersion heaters to the required shape and then flange mount them so they can be easily removed.

A float switch in the reservoir, wired in series with the heater thermostat, is recommended. In this way,

		Water Base Fluids		Non-water Base Fluids	
General Characteristics	**Petroleum Oil**	**Oil in Water Emulsion**	**Water-Glycol Mixture**	**Phosphate Ester Mixture**	**Pure Phosphate Ester**
Solvency	None	None	Removes paint	Removes paint	Removes paint
Approved seal material	Buna N neoprene	Bune N neoprene (no cork)	Buna N Neoprene (no cork)	Butyl Teflon silicone	Butyl Teflon silicone
Approved filters	Cellulose fibre 200 to 300 mesh wire. Knife edge or plate type.	Glass fibre. 200 to 300 mesh wire. Knife edge or plate type.	Cellulose fibre. 200 to 300 mesh wire. Knife edge or plate type.	Cellulose fibre. 200 to 300 mesh wire. Knife edge or plate type.	Fuller's Earth. Cellulose fibre. 200 to 300 mesh wire. Knife edge or plate type.
Suction Strainers and capacity	100 mesh wire 1½ times pump capacity	40 mesh wire 4 times pump capacity	60 mesh wire 4 times pump capacity	50 mesh wire 4 times pump capacity	50 mesh wire 4 times pump capacity
Metals	No effect	No effect	Avoid galv. Avoid zinc pltg. Avoid cad. pltg.	No effect unless fluid has been overheated	No effect unless fluid has been overheated

power will be available to the heating elements through the thermostat as long as fluid is in the reservoir. Should the fluid be too low and the heating element exposed, the float switch would cut off the power source and prevent the heaters from burning out.

This system will maintain a minimum temperature control of the fluid during idle or shutdown time and give a trouble free start up period. When the pump is operating, it will be found that heat will be generated and the fluid temperatures will increase, with the result that the thermostat will have the heaters cut out most of the time.

What type of heat exchanger?

A cooler or heat exchanger, with thermostatically controlled water supply, and mounted in the system will aid in maintaining a maximum operating temperature. A plate type heat exchanger is generally recommended. Heat in conjunction with contaminants is one of the greatest causes of fluid breakdown, resulting in shorter packing life and excessive wear to equipment. The heat exchanger should be mounted in the return line, near the reservoir, to cool the fluid before it is again recirculated. All fluid coming from the relief valve by-pass should also be returned to the reservoir via the cooler.

The water entering the cooler can be metered by cracking the shutoff valve. This method, having the least initial cost, is frequently used. However, over a period of time, it will be found to be more costly due to the waste of water, higher maintenance requirements and general inefficiency. A better method is one which includes a thermostatically controlled shutoff valve, a solenoid controlled shutoff valve and an inlet strainer as shown in the sketch. This assembly should have an inlet and outlet shutoff valve with a by-pass line around them so that the cooler can be operated while the strainer is being cleaned.

A thermostatically controlled shutoff valve, also known as a self-operating temperature regulator or modulating valve, automatically controls the flow of cooling water into the cooler, supplying it only as required. This valve should be one which is normally closed and having a double seat with reverse action. It should have bronze trim and a temperature range of 100 to 140 F. It should also have at least eight feet of flexible brass tubing and a stainless steel bulb. The bulb should be located in the reservoir below fluid level.

It is recommended that the immersion heater thermostat be set to operate at 100 F for a minimum operating temperature, and the heat exchanger water inlet thermostat be set to open at 110 F for a maximum operating temperature. To check efficiency of the thermostats a bulb type thermometer is frequently added to the reservoir for visual inspection.

When a leak occurs

Should a leak occur in the cooling coil of the cooler, the higher pressure of the hydraulic fluid will leak into the water and go out the drain. However, if the hydraulic system is shut down, the hydraulic pressure will drop to zero and the constant water pressure will then leak into the hydraulic fluid, diluting the fluid and eventually overflowing the reservoir.

A solenoid operated shutoff valve, normally closed, is frequently added to the heat exchanger water inlet controls, wired so that the valve is open only when the pump motor is operating. This will shut off the water supply as soon as the pump stops circulating fluid, regardless of water control thermostat setting.

Seals, packings, hoses and such elastomeric items as accumulator bladders and diaphragms, normally furnished for oil hydraulic fluids are not generally compatible with the non-water base fluids. Standard rubber or neoprene tends to swell and soften in the fluid and may not offer the operational reliability for which they were designed. However, seals of butyl rubber, teflon and the silicones are acceptable with non-water base fluids and will give satisfactory service life.

It is only necessary to change the dynamic seals or packings when converting a piece of hydraulic equipment from petroleum oil to a non-water base fluid. Static or trapped seals will swell and make the joint tighter, but should the equipment be disassembled at a later date, it will be impossible to replace the same seal in the part from which it was removed.

Gaskets should be changed

For this reason, it is recommended that all seals and gaskets be changed while the equipment is apart for the changing of dynamic seals. Hoses should also be changed to butyl lined hose. Diaphragms and bladders will need to be changed or eliminated from the circuit.

Seals used with water base fluids need not be changed during the conversion period but should be changed to a more compatible material when equipment is down for periodic maintenance overhaul. One exception to this general statement is the use of cork impregnated seals, particularly those used as shaft seals. The water will swell the cork and bind or freeze on the shaft and cause scoring. It is preferable to replace cork impregnated seals with a more conventional product.

Care with fire-resistant fluids

Equipment supplied with butyl seals for use with non-water base (phosphate ester) type fire resistant fluids should not be bench tested with petroleum oils, as the chemical action of the combined oil and phosphate can cause as much as 50% swelling of the seals.

Metals used in the manufacture of the various hydraulic system components are generally compatible with the fire resistant fluids. However, if the non-water base (phosphate ester) fluids are operated for extended periods of time beyond their recommended thermal limits, there is the possibility that thermal decomposition will take place and the decomposition products could affect some of the metals in the system. When using water and glycol mixtures, zinc and cadmium metals are frequently dissolved with a resultant soap precipitation which may clog the intake strainer. The use of galvanized metal, zinc, or cadmium plated parts should therefore be avoided.

The procedures and precautions mentioned here may appear to be unduly laborious. Actually, all of the indicated steps are in strict accordance with recommended hydraulic practices, both oil and fire resistant. The important considerations are that the system be cleaned initially and that it be maintained as clean as possible. The best answer to the successful use of any of the fire resistant fluids has been good house-keeping and sound maintenance procedures, together with rigid temperature control. ★

Just what is an industrial designer?

A profile of the man and his functions by G. N. Soulis, P.Eng., assistant professor, mechanical engineering, University of Waterloo, Ontario

Within our society there are many people who are concerned with the creation of items or systems which must find a place in society. Only a few are called "industrial designers", despite the fact they all design for industry.

Initially the craftsman was the "industrial designer". In designing and fabricating his product he weighed all those various factors which affected the form of his creation. He weighed, usually unconsciously, not only the mechanical and production factors but also through his intimate knowledge and understanding of his customers, those qualitative factors which we now call by elaborate names such as aesthetics, form, sociological factors, psychological factors, economics, and distribution. In other words, he was aware that he was not creating an item which would exist in a vacuum, but that his creation would be part of a social pattern or system and would be required to fit into that system.

With the advent of the power machine, mass production, and the industrialist, there was a transfer of skill from the craftsman to the engineer or his equivalent. This change was made possible by the development of engineering science techniques. The analytical scientific method was applied and made available in such fields as mechanics, chemistry, electricity and structures. Unfortunately in this transfer of skill there was no transfer in other than these traditional scientific fields. The engineer, because of the increased complexity of the industrial system, became more remote than the craftsman from the concept that a design is not an end in itself but is part of an ever-changing system which is only partly scientific. This led to what is known as the "rationalistic school" of design and it made tremendous strides in the creation of devices which perform a purely mechanical, chemical, electrical or structural function.

However, it became apparent at an early date that this rationalistic approach to design was not wholly adequate to meet the needs of the people.

From craftsman to artist

The initial reaction came from people like William Morris who attempted to return to the craftsman stage. While he did not succeed completely in this direction, he was successful in propagating the idea that these unmeasurable human needs were artistic in nature and that therefore the design of industrial products was an artistic function. Since these factors were beyond the understanding of the engineering scientists of the day, they quickly declared that they were outside their field. The reaction of the industrialist was to call into the design function those people who claimed to have an understanding of these intuitive, non-scientific factors. So what was once one design function was split into two artificially divided functions. Out of this came the birth of the stylist, or in more sophisticated circles, the industrial designer.

The history of design from that date has been the history of the tension between these two quite different viewpoints. In each industry we have seen the pendulum swing from one extreme to the other as each side strives for mastery. While the struggle has been cloaked in much vague language and high sounding terms, it has been basically a struggle on both sides to find a method of designing products which would fulfill the needs of society. One side has tried to build the method around an artistic or intuitive approach while the "rationalistic school" still continues to apply what they feel is a more or less scientific approach.

While the discussions go on endlessly at the educational and ideological level, many people have seen that neither the analytical scientific method nor the artistic method alone form a practical basis for designing methods. Those people who take from all sides the methods and disciplines which have been proven in the day to day operation of the design process are the real industrial designers no matter by what name they are called. They must often carve out their own niche in the industrial hierarchy. Often their training is inadequate for the complex problems of judgement and synthesis attendant with creative design work.

Need for special training

Engineering schools, contrary to the claims of some in the field, still supply a great proportion of these people to industry, but because of limitations in engineering curricula, there has arisen the need for special training and schools for industrial design. Most of these separate institutions have grown out of, or have had their roots in, schools of fine art, or arts and craft schools. The most notable of these schools was Bauhaus of Germany which existed from 1919 to 1933 and which set the pattern for most of today's institutions. While it was essentially artistic in nature it made two fundamental steps forward from the thinking of the arts and crafts traditionalists.

- It recognized the need of technology in the creative function for industry.
- It was able by a particular educational method to free the artist from the traditional aesthetic concepts which were proving quite inadequate for the machine age.

The methods of this school have led to outstanding successes in the field of architecture and related fields

The seven steps to a good design

While actual procedures vary widely, most successful designing follows seven basic steps. In practice these are closely intermingled and cannot necessarily be divided.

Step 1. Define the need for design.

All designs are created to satisfy a consumer need which may exist prior to the design or which may be created by the advent of the design on the market. This overall need is a combination of technological, economic and psychological needs which vary in their emphasis depending upon the nature of the item. To define this need is the first step in the design process.

Industry has devoted much time and attention to methods of making this definition. As a result many facts, figures, and statistics are available. The interpretation and weighing of these is still very much a matter of intuitive guesswork based upon a knowledge of the limitations of this scientific aid and past experience. Since either the intuitive or factual methods alone are rarely completely successful, the person responsible for the definition must be familiar with the techniques and operations of both.

Step 2. Define needs of producer and seller.

Again there is much scientific data available but again the intuitive mental process of weighing and interpreting forms a vital part of the process.

Step 3. Define limits of design.

The third step is to define the limits of design action and within these limits create the "product hypothesis" which as closely as possible fulfills the needs of the consumer, seller and manufacturer. This "hypothesis" may be verbal, visual, or mathematical, or any combination of the three. This step requires analytic and synthetic thought processes as well as the ability to balance, adjust and compromise needs so that they can be compatibly expressed in a product. In this sense, this is a creative process.

Step 4. Test the product hypothesis.

The hypothesis must be revised, and revised again, until it conforms as closely as possible to the needs.

Step 5. Prepare for manufacture.

Step 6. Prepare for sale.

Step 7. Revise and change due to changing needs.

These last four steps in industry are associated with certain rituals and procedures and are usually under the control of experts of widely varying types. The success or failure of these steps depends to a large extent upon the thoroughness and quality of the work done in the first three steps in the design process. Success also hinges on the ability of the people concerned to communicate and apply judgment.

where the problems of mass production, high technical development and mass distribution have not as yet become major factors in the design process.

Recently the limitations of the Bauhaus method in the field of highly industrialized products has been realized by some educators and more and more technology has been introduced into the curricula of artistically orientated schools. With the advent of new fields of scientific investigation such as physchology, sociology, ergonomics and market analysis, some of those areas which were once considered intuitive and artistic in nature are now considered a new form of engineering science. The extreme case of this type of school is the Hochschule fur Gestaltung in Ulm, Germany, whose philosophy might be defined as a training of a broad scientific nature with special emphasis on creative synthesis and practical application.

Is this not engineering?

The engineer might argue that this definition is one of engineering. However, there is an essential and vital difference. While this may be a definition of engineering as it is practiced in some fields it is not a definition of engineering science education in most schools. While traditionally the engineer has thought of himself as a person trained in the broad practical application of science in a creative manner, his education in fact, has remained restricted to the traditional scientific fields and largely ignored the application of those newer scientific studies mentioned above. Also his education has become more and more analytical in nature and the creative function has been reduced to mere construction by means of formula combinations which often ignore the human aspects of a problem.

With this brief historical sketch let us now examine more closely the design process as it functions in most industrial situations and detailed in the accompanying box. In this way, we will arrive at a true definition of the industrial designer.

In all the seven steps of the design process, there are two connecting links which if properly forged make of the design process one over-all function properly balanced in the realms of time, money, and efficiency. They are supervision and communication. The problems attendant with these factors vary accordingly to the size of the organization involved. In cases where one man performs all seven steps, they become a matter of self-discipline and self-knowledge. In very large organizations, they are often the key to success or failure and require as much attention as any of the individual functions.

Within the seven steps and the two overriding considerations of communication and supervision, what is the position of the industrial designer? This depends upon the structure of the company, and to make a single firm definition which would be agreeable to all would require the use of so many generalities that it would be meaningless. However, let us affirm that an industrial designer is a person who has sufficient knowledge, authority, and the proper mental attitude to:

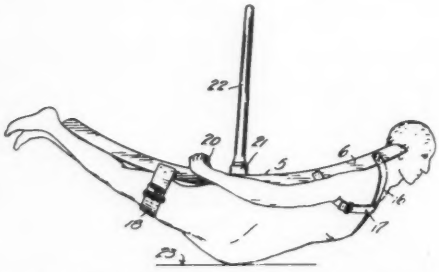
- Supervise the seven design functions as listed.
- Establish and maintain communication and coordination within the total design process.
- Actually perform as well as direct the activities of the "product hypothesis" and also the revisions due to changing needs and limits.

As an industrial designer, he may exercise these functions at various professional levels and in many fields. But this is an entirely different subject and must be left for discussion at some other time. ★

So you think your inventions are crazy . . .

The records show that some of the most outlandish ideas in the world have already been patented

In 1896 J. C. Boyle patented this automatic hat-raising device for lazy gentlemen to fit inside their hats. Just press a spring and up pops your hat.



Losing weight could be terrifying with this 1909 invention. The patient is tied down by straps and iron bars and rocked back and forth by the operator.

For practical jokers, this gives an electric shock when the victim pulls the handles to test his strength. He's spanked by a paddle and frightened by an explosion.

With so many new inventions being developed each day, it's no doubt we wonder just when mankind will run out of fresh ideas. But the stream seems endless.

We were astounded to learn that in the United States alone, the Bureau of Patents last year awarded 50,000 new patents . . . almost 1,000 per week. Inventions, like rabbits, merely seem to beget more and more inventions.

For example, the makers of Eveready batteries told us of the reams of records they have about battery-operated inventions. Some were crazy, while others were simply morbid.

One of the sanest was a flashlight which served as both a night stick and alarm. Inventor Rubin Duffy Lewis of Scarsdale, New York, foresaw his gadget as a boon to nightwatchmen, or women who had forgotten their hatpins. Hit someone over the head with it, or drop it, and the alarm went off.

That's mild compared with a combination flashlight, gun and billy invented by two California men in 1949. It could be used by guards, soldiers or policemen to crack somebody over the skull, blind him with tear gas or riddle him with bullets.

Illuminated yo-yo

On the lighter side, battery-operated inventions included an illuminated darning ball, an illuminated yo-yo and a child's teddy-bear with a built-in heater.

In 1911, an Alabama man invented a rocking chair aimed at increasing Southern comfort. At the base it had a fan to keep the air circulating. "Another object," said inventor Mike Lutenberger, "is to provide a chair with a cooling chamber in which can be stored fruit, bottles of liquid and other matter for the convenient use of the occupant."

Even more imaginative was the electrical bedbug-exterminator, patented by New Yorker Frank M. Archer back in 1898. Quoth the inventor: "It consists of electrical devices applied to bedsteads in such a manner that currents of electricity will be sent through the bodies of the bugs, which will either kill them or startle them, so they will leave the bed."

So whether you have ideas for a compact demisting unit and windshield wiper for spectacles, or an automatic shower for the canary's cage, make some investigations first. It may already have been patented.

But please don't let that discourage you from trying.

What Would Americans Do?

An editorial from The OTTAWA JOURNAL, July 4, 1961

If three out of every four magazines read by Americans were imported from Canada;

If in a single year Americans read 147,000,000 copies of Canadian magazines compared to 45,000,000 copies of their own magazines;

If distribution of 40 per cent of all magazines sold on U.S. newsstands was controlled by two Canadian companies;

If two Canadian-owned and controlled magazines publishing so-called "U.S. editions" in the U.S. were taking between them 40 per cent of all U.S. consumer magazine advertising;

If these two Canadian-owned "U.S. editions" in the U.S. were using second-hand editorial material from a Canadian parent editorial pool to provide unfair competition for U.S. magazines, threatening them with extinction;

If these Canadian-owned magazines with their "U.S. editions" were reaping profits not only greater than the profits of American magazines but greater even than the profits of their parent Canadian companies—in such circumstances, WHAT WOULD AMERICANS DO?

We think we know what they would do. And we think also that they would do it *without asking or waiting for permission from Canada.*

And the Americans would be right.

For if a nation be unwilling to safeguard its own communications, or be afraid to safeguard them, it is hardly fit to be a nation.

The report of the Royal Commission on Publications went out of its way to try to explain this to Americans—to appeal to their sense of what was just and fair. And if ever a report was free of anti-Americanism, it was this report.

* * *

Some Canadian editors—happily not a majority—have been saying that the recommendations of the Royal Commission would interfere with the "free flow of ideas."

The only comment that can be made on this—made perhaps more in the interest of charity than of truth—is that editors speaking such nonsense cannot have read the report.

For not a line, not a word, not a syllable in the report recommended or suggested anything which in any way whatsoever would interfere with the editorial content, the views or the ideas of any American magazine entering Canada.

To speak of "a sort of censorship," as one Toronto newspaper has spoken of it, is either to betray gross stupidity, or to willingly do violence to language.

Not an editorial line nor word in any American magazine entering Canada would be censored or taxed or in any way interfered with. *Time* magazine as it is published in the U.S., *Reader's Digest* as it is published in the U.S., the *Saturday Evening Post* as it is published in the U.S., the *Atlantic Monthly*, *Harpers*, all U.S. magazines as they are published in the U.S., would enter Canada as they enter Canada now. No interference whatsoever would there be with readers' preference.

Only when American magazines changed from what they were in their own country and made themselves, for extra profit, into carriers or packaging for advertising directed to Canadian consumers, would they be touched.

Where the censorship there? Where the tax on ideas? Where the interference with the "free flow of information"?

And speaking of the "free flow of information," what about the free flow of Canadian information—the free flow of information east and west in Canada; between Canadian provinces? Is that to be dammed, stopped, so that Mr. HENRY LUCE'S vast magazine empire may reap greater profits from Canadian advertising?

* * *

Time magazine, cries a *Time* appeal to Canadians, should not be driven out of Canada.

What would be driven out of Canada? *Time* (Canada), a split-run device to garner Canadian advertising at the expense of Canadian periodicals, at the expense of Canada's own communications, never was in Canada.

Time (Canada) was owned in the U.S. *Time* (Canada's) so-called Canadian news was edited and processed in New York. *Time* (Canada) was printed in Chicago. *Time* (Canada) was mailed to its Canadian subscribers from Chicago—its postage paid to the U.S. post office. *Time* (Canada) had no physical assets in Canada—nothing but what it called its publishing office in Montreal (actually the office of its distinguished counsel), plus an office in Toronto from which its amiable Mr. LARRY LAYBOURNE sold Canadian advertising.

That was—and is—*Time* in Canada; the very refinement of a split-run, a pure unadulterated device to make substantial profits for Mr. HENRY LUCE out of Canadian advertising (it should be said for Mr. LUCE, however, that he publicly repudiated the claim of his subordinates that *Time* (Canada) was a Canadian magazine).

* * *

THE JOURNAL must say that for *Reader's Digest* it has a degree of sympathy; it has never claimed that it was a "Canadian magazine," it did in some measure operate in Canada, employing Canadians and Canadian materials, and it is in a sense a magazine of universal appeal, though why, God only knows. If, therefore, some sort of exception could be made of it, perhaps not many Canadians would mind. The question is how to do it.

* * *

Nevertheless, if a choice has to be made between the continued existence in Canada of *Time* (Canada) and *Reader's Digest* and the existence of our own Canadian publications—our own Canadian communications—then surely there can be no doubt nor question over what that choice should be.

If we are unwilling or afraid to make the choice, let ourselves be bamboozled by ignorant talk about "press freedom" and "censorship," then for Heaven's sake and our own integrity let's stop talking about "Canadianism."

THE REPORT OF THE ROYAL COMMISSION ON PUBLICATIONS

to the Government of Canada is important to the people of Canada, it is important also to those in the United States desirous of understanding their neighbours.

Complete copies of the 259 page report are available from the Queen's Printer, Ottawa, Canada. Price $3.00.

This advertisement sponsored by

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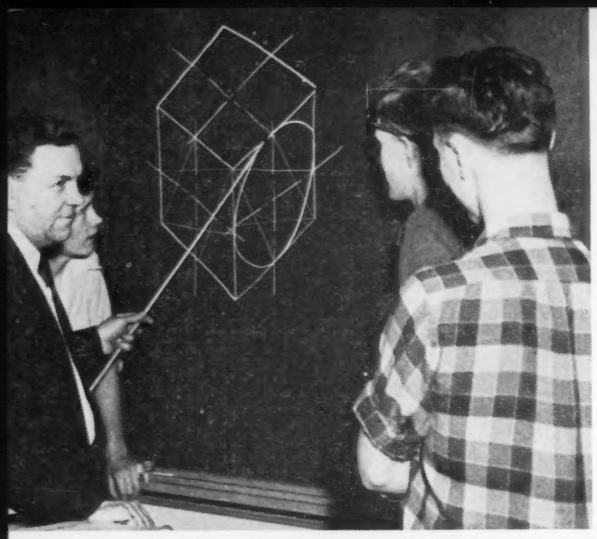


The author instructing students at Bathurst Heights Collegiate, Toronto.

Ontario's schools cry out for technical teachers

H. F. Skinner, B.Sc., technical director of Toronto's Victoria Park Secondary School tells of a bid to woo more teachers

Ontario plans to spend $100,000,000 over the next 18 months as part of a bold new approach to Canada's present-day manpower problem. The plan is expected to provide an extra 50,000 pupil spaces, many in rural areas where technical education has never before been available. To man these new areas the need for technical and vocational school teachers is acute.

We are living in an age when the scope and amount of scientific-technical knowledge, coupled with the ability on the part of its citizens to apply it, can determine the welfare of the nation. During the last few years newspapers and magazines, radio and television, citizen's groups and industrial people have added to the increasing clamor for greater numbers of competent scientists, engineers, and adequate and well-trained technical personnel.

These people are needed now to meet the demand of our present technological era. There is a vast scientific threshold confronting us. The realization, for a technical force several times greater than is now available, in the next decade, is of utmost importance.

In spite of our rapid increase in population, there is an insufficient number of people joining our "technical educators" programs to produce the manpower force required. Recognizing this, the Ontario College of Education is making a concerted effort to enlist people to become technical educators. If we are to meet the future needs of our social and economic structure, we must educate these technicians and properly employ them.

They are a part of a team composed of the scientist, the engineer, the technician, and the craftsman. The scientist needs the engineer to develop a practical application for his theories. The engineer needs a technician to work with him to put the theories to practical use. The technician and draftsman prepare the plans and the tradesman builds the machine, the instruments. This approach to a more effective and economical use of manpower in no way infers that our present engineering education, at the college level, is over emphasized or that the demand for engineers is decreasing. On the contrary industry needs and can use all the graduate engineers and scientists that can be obtained. However, without a program to educate technicians, there will not be the staff to meet our technological needs.

A great deal of attention has been directed to the problems related to the selection and preparation of technical teachers. Organized experiences must be provided if the preparation is to be adequate and excellent in quality. Although many are involved in the preparation of the technicians, no one is more involved or more important to the success of the undertaking than the teacher whose responsibility it is to train them.

What are educational requirements?

It is the desire of the Department of Education in Ontario to recruit two hundred and fifty highly skilled technical teachers meeting the following qualifications:

1. Minimum of grade 12 standing, either from a General or a Technical course. Equivalents from overseas, such as the National certificates from Britain, will be considered. If the candidate has higher than grade 12 standing, his initial salary is improved. University-trained teachers, in particular, are desired.

2. From six to eight years of approved industrial experience in the trade or technology he desires to teach; for example, woodworking, electronics, welding and sheet metal require six years of experience, while all others require eight years.

3. An eight months' course in teaching methods at the Ontario College of Education.

4. A real desire to work with young people.

5. Until recently the age limit for entrance into the profession has been thirty-five, but candidates up to forty-five years of age and meeting all other requirements, will be considered.

Some typical courses

What type of courses will these new teachers be instructing in? What facilities will they have available for their classroom activities? Will they be required to handle other subjects, such as maths or chemistry?

The following is a brief description of some of the courses taught in the schools in Ontario. There is no reason to suspect that there will be any major changes in these courses within the next year or so. Of course, the curricula are being updated regularly to keep up with changing trends in industry, and every teacher is expected to keep himself well informed of what is new in his field.

The course in drafting is designed to give the students skills and abilities in the use of drawing instru-

ments. The science of drafting is based upon orthographic projection. Within this area students learn to plan, sketch, design, and prepare working drawings. Students are taught the fundamentals of machine design involving cams, gears, jigs, etc., strength of materials, structural steel drawing and pictorial drawing.

The student acquires professional skill in the use of drafting machines, lettering devices, special engineering instruments and other drafting equipment. Drafting is a form of communication similar to reading and writing and performs the same function in industrial technology that reading and writing provides for education in general.

A second area of work can be divided into electricity and electronics. Fundamental instruction in electricity consists of experience with apparatus, tools, and materials so students may make applications with sources of power, circuitry, and switch gear. Emphasis is placed on fundamental theory, circuits, equipment devices, operation of component parts, installation and maintenance of equipment, use and control of power, computation, and testing.

Advanced work in electronics is concerned with the characteristics, properties, and practical application of electrons in vacuum or gas filled tubes and semi-conductors. The application of electronics principles can be applied to communications (microwave transmission, radar, radio, sonar, telemetering and television) and industrial controls (computers, motor controls and servo-mechanisms).

As an experienced teacher who spent a number of years working in industry before entering the teaching profession, let me emphasize that the work has many rewards. A gratifying career in the training of Canada's youth could await you by enlisting in the technical teaching profession. May I suggest you do it now. ★

Here are the answers to some important questions about TE . . .

1. What is Technical Education?

The specific aims of Technical Education are:

- Education that emphasizes the learning of a technique or technical procedures.
- To provide experiences with tools and machines typical of modern industry.
- To develop technical skills in shop work and drafting that represents good industrial practice.

2. What does Technical Education teaching have to offer as a profession?

- It offers an opportunity for working with the most important raw material in our society, namely boys.
- It offers variety.
- It provides experiences in shop atmosphere which most boys enjoy.
- It provides a reasonable income (salary conditions in the teaching profession continue to improve and special pay allowances are made for educational and experience credits).
- The teaching profession provides sufficiently long vacation period so that teachers may attend school for further education, may travel, may pursue hobbies, or may simply rest.
- Teaching profession provides security.

3. What type of person is required for teaching in technical education?

- A person of above-average technical ability.
- An individual who is interested in working with young people.
- An individual with desirable personal qualities.
- One who is interested in working and experimenting with materials, tools and processes, and who has experienced some success in such work.
- One who can work with other people.

4. What actual positions need to be filled?

- Technical educators are needed in such shops as automotive, electricity, electronics, mechanical drafting, machine shop and others.
- There are opportunities for advancement in the teaching profession for those with ambition. After teaching two years, a candidate with Grade 13 educational credits who is rated above-average as a teacher may enroll in summer courses leading to a Vocational Specialist certificate, whereby he augments his salary and becomes eligible for promotion to a Shop Directorship. Summer and evening courses are available at all Ontario's universities to permit the acquisition of recognized degrees.

5. What must I do to become a Technical Teacher?

- You must complete an eight-months course in teaching methods at the Ontario College of Education. The principal subjects are: Principles of Teaching, Practice Teaching, Psychology, School Law and Regulations, English, History of Vocational Education, and certain technical subjects such as Trade Analysis, Courses of Study and Shop Planning.

6. What are the costs of preparing as a Technical Teacher?

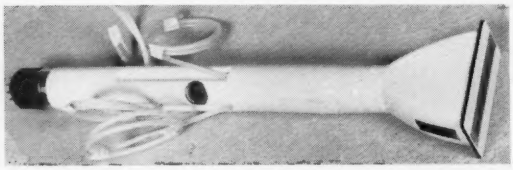
- The Government of Ontario will pay the fees of successful candidates.
- The Government will also pay a subsistence allowance of thirty dollars per week during the eight months training period.

7. Where may I apply?

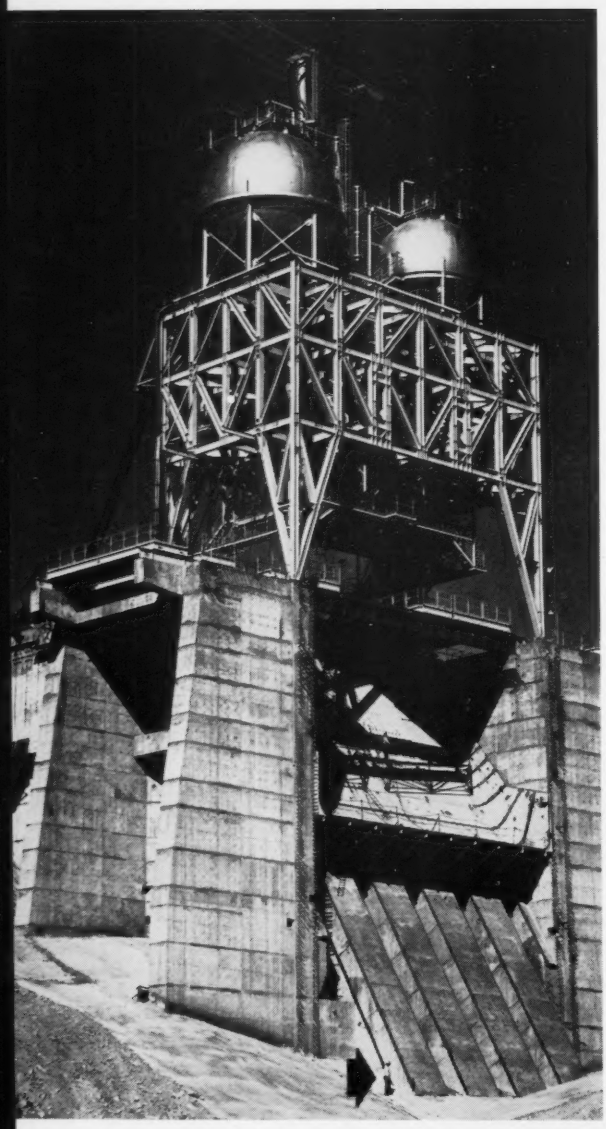
- For applications apply to:
  Professor R. D. Phillips,
  Director of Vocational Teacher Education,
  Ontario College of Education,
  371 Bloor St. West,
  Toronto 5, Ontario.

Designews in pictures

Zinc coated steel strip rises from the pot in a new 950-foot galvanizing line at Steel Company of Canada.



A modern concept of a modern device . . . the direct writing cathode ray tube.

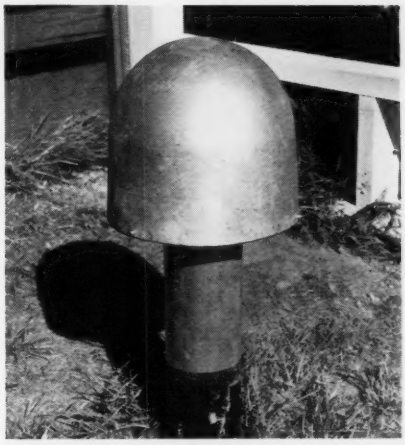


Largest rocket engine test stand in the free world is nearing completion in California. Note man, arrowed.

Don't worry if you accidentally drive over this inspection lamp. Its transparent butyrate tube will not break.

An aerial view catches the unusual pattern of a new Fren·h housing development at Pantin near Paris.

This is a remote control camera specially designed for photographing the inside of underground storm sewers.

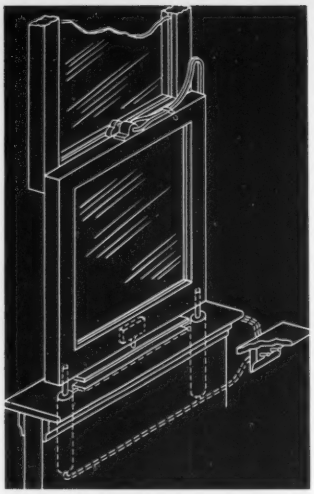


Not a huge mushroom but an aluminum terminal box used by B.C. Telephone Co.

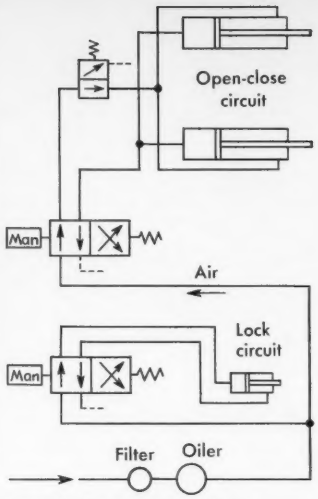
Push-buttons replace the old rotary dial on new telephones now being tested in Canada.

Utilizing air power in the home

The average housewife has many odd jobs that air power can do, says Thomas Baxter of Leland Electric Company Limited



Sketch showing how two small air cylinder can be used for opening and closing windows.



Installation diagram shows simplicity of the system, at left, which uses air power to operate windows.

It is inevitable that a man who is working with a medium or commodity in his everyday business life will turn his thoughts occasionally to considerations of its potential in that other department of his life, his home. We must admit that we have often thought of the many benefits to be derived from the application of air power to uses in the home . . . and here are some of the things we have been thinking.

The lady of the house spends much of her life in the kitchen. The majority of the windows used in this country are still of the double hung variety. To operate the kitchen window, the housewife is usually called upon to lean over a sink or countertop two feet wide and at arms length manipulate the lock and raise or lower the window. This requires considerable effort. Tests made indicate that up to 30 lb is required to set the window sash in motion and 5 to 10 lb to maintain motion. Greater window clearances to reduce the starting effort only mean drafts in the winter time. Here is one application where two small air cylinders of ½ in. diameter would do the work admirably, with no strain upon the housewife.

Cylinder for locking

A small cylinder on top of the sash replaces the usual lock and this is controlled by a separate manually operated valve. To guard against trapped fingers or other obstruction there is a sensing bar at the bottom of the sash which is coupled to a two way valve in the window itself. In normal operation, this fits into a recess in the sill, but if it should meet with an obstruction, it unloads the air which would be normally fed to close the window. All the equipment to do this is now manufactured for industrial use, including the latest diminutive filters and oilers, and $50 per window is not too high a sum to expend in making the lot of the homemaker easier.

It is customary in many of the modern homes to have only the lower sashes of windows capable of being opened, yet, for the purposes of proper ventilation a strong case could be made out for making both sashes openable. This has not been done up till now because of the manual effort involved. With air power, it is a simple matter, requiring merely the operation of a switch.

Counterweights and springs would no longer be necessary with an air operated window since the air itself would support the window's weight. Where desired, flow control valves on the exhaust ports of the valves would render the movement of the windows as smooth as silk.

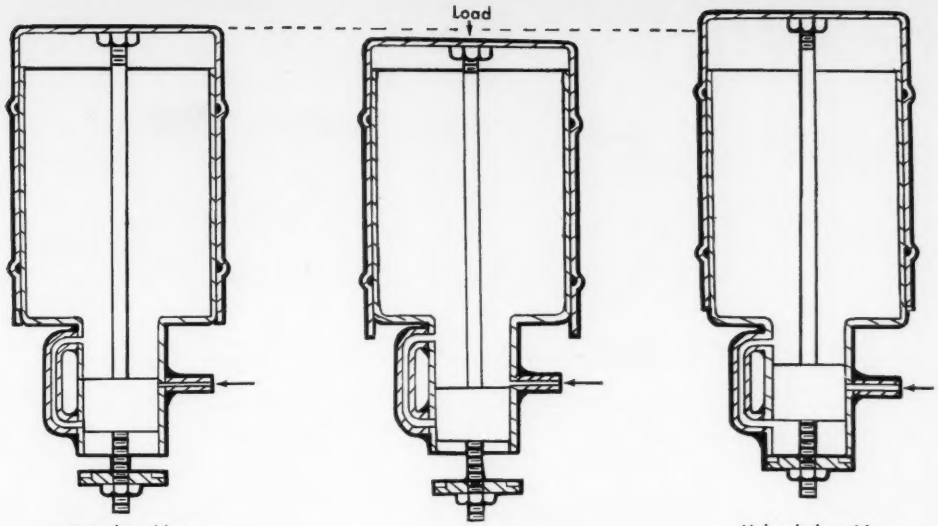
No limit to its use

Once compressed air has been introduced into a house there is scarcely any limit to the uses to which it may be put. It is but a short step from the air operated manually controlled window to the window which will open and close itself. The upper sashes of the windows could be arranged to open under the influence of a CO_2 sensing device while the lower sashes of bedroom windows could be closed automatically in the event of rain.

The home-owner who has spent $300 to $400 for drapes for the living room picture window will not be averse to spending $50 to $60 in the pneumatic home for an air cylinder and valve to draw these drapes. Having attained this, a little extra money would procure a temperature sensing unit attached to the inside window to draw the drapes when the sun is shining in and thus prevent furniture from fading.

For everything that has been so far mentioned, a small compressor driven by a ¼ hp motor would be adequate and would still provide enough air for such obvious jobs as opening and closing the garage door. The equipment for this would be much simpler than the present electrically operated ones.

In the kitchen the housewife relies quite heavily on her mixing machine. An air driven one would be lighter and smaller as well as being shock proof — a not unimportant factor with the ladies. It could be plugged into the wall in the same manner as its present electrical counterpart. Similarly, the electric razor could be re-



placed by the more robust air driven razor. The use of the latter would enable electrical outlets to be removed completely from the bathroom where any electrical appliance connected via a flexible cord is a potential source of danger.

It works on furniture too

One of the greatest disadvantages of our present furniture using steel springs is that the springs fatigue; sooner or later in its life, there will be either sags or lumps in the furniture.

The compressed air home will be able to use furniture with air springs so that on a chesterfield a 200 lb person could sit next to a 100 lb person and both would be level. The spring consists of two canisters, the outer one sliding over the inner one and containing O-rings for sealing. The lower end of the inner one is brought down to a neck housing a simple valve. The sketch above shows the spring in the 'at rest' position. The further inlet of air is cut off by the piston covering the inlet port. The piston is also trapping air already contained The piston is connected to the outer shell by a piston rod.

Now when a load is applied the movement causes the piston to allow more air in until the outer shell moves back to its original position, once more blocking the inlet port. Similarly when the load is removed the shell rises, causing the piston to uncover the lower part and allowing the excess air to escape.

It will be noted that the spring operates on the difference between the areas of the end of the outer shell and the area of the lower piston. A chesterfield or chair having a bank of such air springs in it could be plugged into a wall outlet. Inside the furniture, the air inlet would be led to a pressure reducing valve built into the furniture, thence to a safety valve and then to the bank of air springs. It is true that such a piece of furniture would cost a little more than the conventional type, but market research indicates that a higher price is a stimulant rather than a deterrent for new equipment working on new ideas.

How about washing machines?

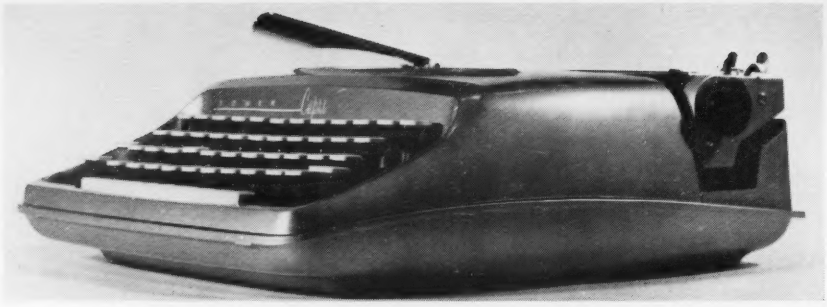
Once compressed air has been sold into the home its ramifications will be limited only by the ingenuity of the occupants. In the British Patent Office files there is a washing machine which uses the air provided by a small fan to agitate the water and thus wash the clothes. Such a principle, but using compressed air might well give the now firmly established electrically driven washing machine a run for its money, to say nothing of its potentialities in dish washing. True, a home with such devices would require something a little larger than the compresser previously mentioned driven by a ¼ hp motor, but it still can be done.

Recently a magazine article described how a doctor had invented an artificial muscle and how with the help of a friend, an orthopedic surgeon, this muscle had been fitted to several patients suffering from paralysis. This device is an air cylinder, but unlike the conventional cylinders, this one bulges like a bicep when energized. To activate this device the patient carries a small tank of carbon dioxide. It is possible that in the home of the future (and it need not be a too distant future) those unfortunate enough to be stricken with paralysis may plug their air muscles directly into a compressed air supply instead of having to carry around the canister of CO_2.

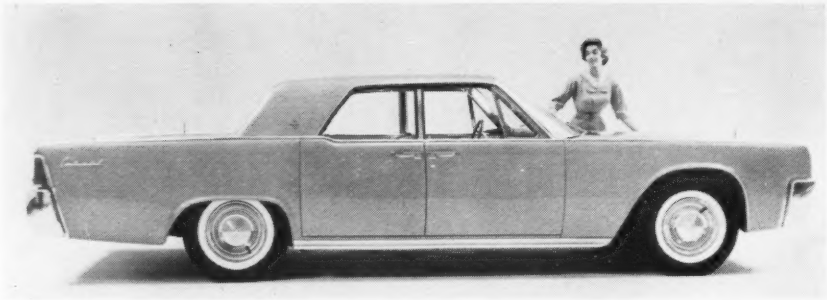
The foregoing are only a few of the uses to which compressed air may be put in the home and may serve to show that a greater degree of labor saving is possible in the home in which pneumatics play a part than in the all-electric one. Some of the ladies' magazines have deplored the loss to the country of highly educated women when they take on family responsibilities and duties. The air home may enable these women to give more of their time to their universities, laboratories, hospitals and schools than is now possible.

Possibly the earliest recorded use of air was by man bringing the smouldering family fire back to life by blowing into it, firstly using his lungs and later by means of the early bellows. It is only fitting therefore that since the first use of compressed air was in the home, it should once again be used there after all the years it has served only industry. ★

Tasteful design in a low-cost product helped win the second IDI award for designers of this Tower Capri portable typewriter.



The new Lincoln is the second in its family to pull out an IDI award. It was cited as an example of good taste.



Design leaders in consumer products

The eleventh annual award program of the Industrial Designers Institute honors seven U. S. designers for the second time in six years

America's top industrial design awards have been announced for the year just passed. And the three winning items, from a luxury auto through a portable typewriter to a child's toy have again reflected the diversified activities of the industrial designer in the ever-widening field of consumer products.

The awards are annual tokens from the Industrial Designers' Institute which appoints a six man panel to seek out the designers or design teams, regardless of affiliation, who have shown the most noteworthy, fresh approach to the design of a product mass produced and nationally distributed within the United States. Each year three products, considered of equal merit, are chosen to determine the medalists. 1961 recipients were:

- George W. Walker, Eugene Bordinat, Jr., Elwood P. Engel, John Najjar, Robert M. Thomas and Don R. DeLaRossa of the Ford Motor Company styling staff for the design of the 1961 Lincoln Continental;
- Arnold J. Copeland, Robert Baker and Robert Y. Kimura of Visual Marketing Inc. for the design of the Educational Project Kits for General Electric Company;
- Carl W. Sundberg, Montgomery Ferar, Richard W. Figgins and Toshihiko Sakow of Sundberg-Ferar Inc. for the design of the Tower Capri portable typewriter for Sears, Roebuck & Company.

Walker, Engel, Bordinat and Najjar of Ford were on the 1956 team which designed the prizewinning Lincoln Premiere Hardtop. Sundberg, Ferar and Figgins were on the 1957 winning team which designed IBM's RAMAC accounting machine.

IDI president Leon Gordon Miller said General Electric's winning product demonstrated an imaginative approach to an educational unit activity with beautiful handling of the precision and design of the specific product. {The GE kits present an absorbing yet simple method for teaching youngsters basic electrical theory, chemistry and even how an analog computer works.}

Jon Hauser, Chairman of the Award program, and a panelist, described the Lincoln as a very successful accomplishment in the integration of the problems of satisfying demand for good taste in automobile design. The Tower Capri typewriter was an outstanding example of good design applied to a low-cost product. He said consumer acceptance defied the marketing concepts of flamboyance in low-cost items. It was proof that good taste was not a matter of affluence. ★

Part 1:

Design clues for investment casting

A. A. Knapp of the Canadian Copper & Brass Development Association summarizes information supplied by the Investment Casting Institute

Typical investment castings show usefulness of the process for intricate work.

During World War II, mass production of small parts for use in strategic equipment such as radar and aircraft was in critical need of a more economical method of manufacture. As a result, new techniques and materials were devised to adapt investment casting to the manufacture of these small and intricate parts.

Investment casting was by no means a new process. In fact, the original process can be traced back to the Shang Dynasty 1766-1122 B.C. and, before its application to industrial purposes, it was widely used in the casting of dentures and jewelry.

The application of the investment casting process to the manufacture of small parts during the war resulted in great savings in strategic materials and in manhours. Also, it became the proving ground for this previously limited process. Today, investment casting is finding wide application in many varied manufacturing industries.

There are basically four distinct advantages for using investment casting.

- Close dimensional tolerance control. Subsequent machining operations are therefore eliminated or minimized.
- A broad selection of surface finishes. Expensive polishing and buffing operations may be eliminated.
- Ability to produce parts of intricate shapes. Expensive assemblies and weldments can be consolidated into a single part.
- High temperature alloys. Extremely difficult and expensive-to-machine alloys can be utilized.

There are also certain limitations on the process. As the size of the casting increases, smoothness and accuracy become increasingly difficult to maintain. Generally, investment casting is most desirable for casting of parts weighing less than 1 lb, but castings weighing as much as 5 lb have been made successfully on a production basis.

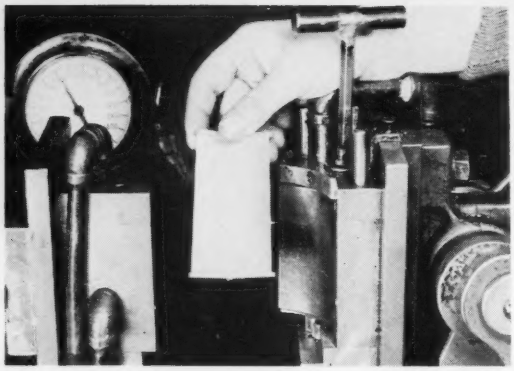
Although the most important application of investment casting is in the casting of alloys and shapes that are difficult or impossible to forge or machine, it is also applicable under different conditions. Expensive machining operations can be eliminated when the process is carried out with forgeable and machineable alloys. It may be used to replace die casting where production quantities are small, and also to eliminate expensive machine set-ups or costly forging dies for trial runs.

The investment casting process

Expendable patterns of waxes or plastics that will melt, vaporize, or burn completely leaving no residue must be produced by the injection of the pattern material into metal dies. The dies are usually prepared by casting two halves in strong metal shoes around metal master patterns. Master patterns must be made with proper allowances for shrinkage of both the wax or plastic and the metal to be cast.

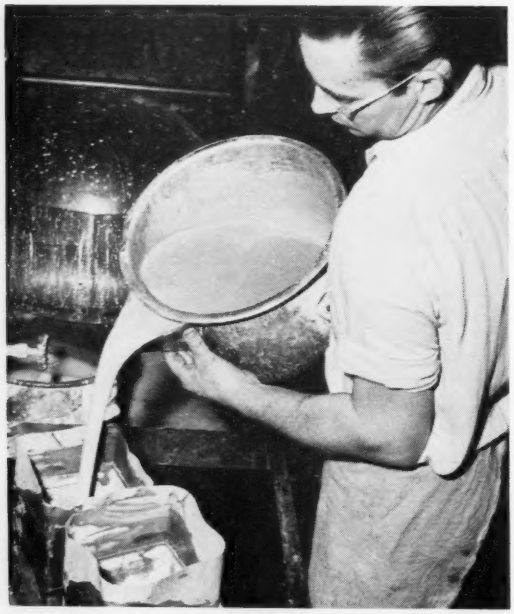
Wax patterns can be produced economically by using cast alloy dies. Plastic patterns however require machined and hardened steel dies and they are only recommended for long-run jobs requiring excessive detailing. If the intricate detail required is easier to produce in a positive master pattern than a negative die impression, then wax patterns should be used. Special waxes with dimensional stability have been developed in recent years to meet the requirements of the investment casting process.

After the expendable patterns are made, they are assembled with wax gates and risers. Several factors must be considered before mounting the patterns. The number being attached to a single sprue is governed by the size of the pattern, the distance that must separate the patterns in the mold, the size of the flask, and the furnace melting capacity. The location of each individual pattern must be such as to permit proper



Wax pattern of jet engine blade being removed from the mold by operator.

Patterns are precoated with ceramic material which, when baked, imparts a smooth glazed finish to the mold.



Mixture of investment water being poured into "can." This is the ceramic material which becomes the mold.

feeding of the metal into the mold, and removal of wax, as well as to produce uniform cooling in each part.

Surfaces must be clean

All surfaces of the pattern must then be cleaned to remove grease and dirt. The assemblies are next precoated by dipping or spraying with a slurry of fine-grained refractory and binder, inactive with the alloy to be cast. The precoat material is usually a well-graded but fine silica refractory with a binder of ethyl silicate or sodium silicate. Other refractories include sillimanite, zirconia, cristobalite, alumina, titana and trydymite. After transfer to the investment mold, the primary investment serves as a mold-facing material.

The tree of coated wax patterns is then fastened by means of molten wax to a sheet metal plate with the header downwards. A metal flask is placed over the assembly, and also sealed to the plate by wax. Coarser refractory material with liquid binder is then poured around the cluster of patterns. For the casting of nonferrous alloys that have melting points less than 2,000 F, such as high-tensile brass and silicon brass, plaster of Paris is adequate as the binding medium for silica or other refractory materials. For alloys with higher melting points, silica generally forms the base of the mold and the binding agent is frequently "organic" silica formed by the hydrolysis of ethyl silicate. The flask is then vibrated to free any entrapped air and to ensure complete filling of the mold. Vacuum may also be used to remove air or gas.

The operation of precoating and surrounding with a slurry is known as "investing" and this term is used to designate the entire process.

Excess alcohol or moisture (depending on the type of binder used) is removed by allowing the invested mold to air-set for a predetermined time. Following this, it is heated at a low temperature (230-250 F) to complete the chemical reaction and to remove the bulk of the wax by melting.

After the low-temperature treatment, the molds are given a high-temperature firing at 1,300 to 1,850 F to remove residual wax or to burn out the plastic pattern. Carbonaceous matter must be completely eliminated. When the mold has been thoroughly soaked at the desired temperature, it is ready to receive the molten charge.

Small indirect-arc or induction furnaces are used to melt the charge. Gas melting is often used for alloys having a low melting point. Whatever type of furnace is used, every precaution should be taken to ensure clean melts and sound castings. Castings may be poured statically or centrifugally, either from a ladle or directly from the melting crucible, or by pressure castings using air pressure to ensure that all details in the mold are filled. The low temperature alloys and some high temperature alloys may be poured.

After sufficient time is given for the metal to solidify, the investment is removed from the flask using a pneumatic hammer. The cluster of castings can be cleaned by grit-blasting. Gates or runners are cut-off by a friction saw or abrasive cut-off wheel and the gates ground flush.

Structural parts may be used without being finished while functional parts may be subjected to light abrasive grinding or buffing. The castings are then submitted to whatever inspection is specified for dimensions and quality, such as visual, radiographic, magnetic particle and fluorescent penetrant inspection.

Design aspects of investment casting

Of primary importance to the design engineer is the surface finish, tolerances, positioning of holes, etc., that are possible with the investment casting process. In the following sections dealing with these subjects, reference will be made to the "functional" and the "as cast" conditions. "Functional" will refer to parts that have undergone subsequent finishing operations such as straightening or polishing, and "as cast" will refer to parts on which no such operations have been performed.

Surface finish

The degree of quality of the surface finish attainable with the investment casting process will depend upon the metal being cast. For example, with AMS 4640 Bronze, surface finish in the "as cast" condition can vary from 60 to 100 RMS (root-mean-square, average deviation from mean surface in micro-inches) and in the "functional" condition can vary from 60 to 100 RMS. In comparison, the surface finish of a 400-series stainless steel can vary from 100 to 125 RMS in the "as cast" condition and 60 to 125 RMS in the "functional" condition. The values given in these cases are the limits between which any mass-produced quantity of parts can be confidently expected to fall. In order to ensure acceptable castings and to permit a greater degree of freedom in the foundry, the designer should specify the maximum permissible RMS value and consider all lower readings as acceptable.

Functional and general tolerances

Depending upon the size and configuration of a part, the functional tolerances will vary from one part to another. In general, for dimensions up to 1.000 in. the permissible tolerance is ±.005 in., and for dimensions of 1.000 in. and over the permissible tolerance is ±.005 inches per inch. Tolerances of ±.003 in. for dimensions to ±.250 in. and ±.004 in. for dimensions from .251 in. to .500 in. can be maintained for special cases, but they should not be requested unless absolutely necessary, because of their unfavorable effect on casting cost.

Tolerances applied to nonfunctional areas should be as generous as possible to ensure economical production. Table 1 shows the standard acceptable tolerances for such areas.

Table I. Tolerances for non-functional areas in investment casting.

Dimension	Tolerance
.002″-2″	±1/64″
2″-4″	±1/32″
4″-6″	±3/64″
over 6″	±1/16″

Radii

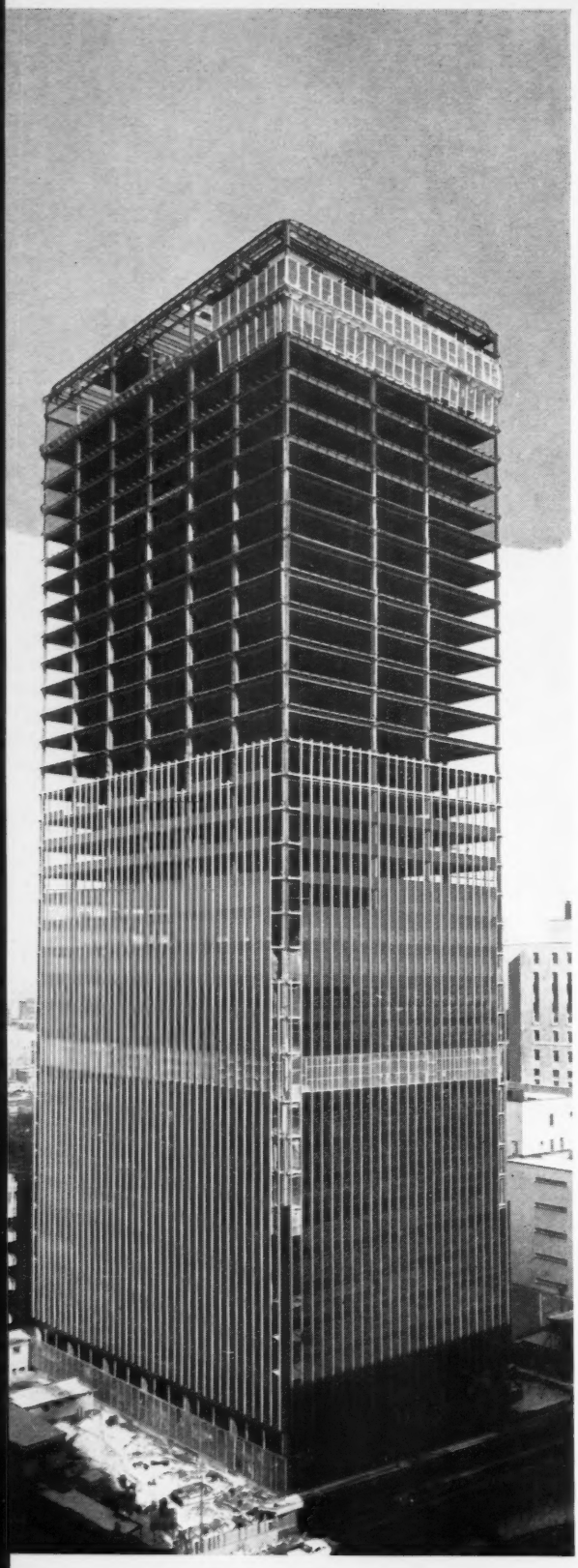
Because accurate inspection of radii on a production basis is not readily attainable, it is suggested that a minimum tolerance span of ±1/64 in. be established for all small radii, and ±1/64 in. for each 2 in. of radius or fraction thereof for larger radii, with a minimum tolerance of ±1/64 in. For special cases where a small tolerance span is necessary ±.005 in. can be held. These tolerance values are the absolute minimum achievable, and apply to both internal and external radii.

More design details next month in part 2 of this series.

Casting floor with burn-out furnaces at left and row of carbon arc roll-over furnaces at right.

Breaking out casting from mold after it has cooled. Refractory coating on castings at left will later be sand-blasted.

Abrasive cut-off wheel separates group of castings from gates and sprues. They have already been sand-blasted.



The new 34-story CIL House in Montreal: walls were tested like any modern aircraft.

Aircraft company turns know-how to product design

R. T. Noe, Architectural Products Division of Canadair Ltd., describes the development of a curtainwall

Today's streamlined commercial aircraft are constantly being subjected to enormous stresses and strains as they make their way above the clouds with their valuable payloads. And this is the main reason that their manufacturers take so much trouble to design and test their product to stand up to the most extreme conditions likely to be encountered.

With today's modern buildings rearing their heads almost into the clouds, a similar cold calculating engineering approach must be taken to their design. Canadair Limited, Canada's largest aircraft manufacturer, recently demonstrated this approach when it turned its hand to the design and production of a metal curtainwall facade for the new 34-story CIL building in Montreal.

To do the job company engineers had to set their sights on certain objectives:

1. Compliance with specific performance and reliability criteria.
2. Absolute integrity of primary and secondary sealing systems.
3. Elimination of on the site sealing and caulking.
4. Individual unit assembly replacement.
5. Fatigue-resistant construction.
6. Simplicity of manufacture.
7. Rapid erection at the site.

Special test facilities built

To do the testing Canadair programmed construction and operation of dual test facilities: a prototype facility for checking large curtainwall sections as a unit, and a development facility for investigating component details. In their program engineers were able to take advantage of the company's prime role as aircraft manufacturer and they found good use for a hangar and some airplane engines.

The prototype facility was built into the side of an aircraft hangar and held a test specimen 14 x 20 feet comprising three typical glass modules of the curtainwall. To test thermal performance it was necessary to achieve precise simulation of internal as well as external environment, and the specimen was backed-up by a room of measurements similar to an executive office in the new CIL building.

The test room was equipped with identical produc-

tion air conditioning induction units, typical blinds and even electrical fittings. Primary air was supplied at pressures up to 2.8 inches water and at temperatures from 56 to 150 F with a tolerance of ±2 F. Chilled water for the cooling coils was pumped from a refrigerated tank at any temperature from 40 to 70 F with a tolerance of ±2 F. There was also provision for a hot water supply, while Canadair designed and manufactured a dehumidification system to control moisture content.

Pressure cell constructed

External equipment for the prototype facility basically comprised a static pressure cell and two dynamic wind pressure generators. The pressure cell was a large wooden structure fitted over the outside of the test specimen and mechanically secured to the steel framework. It was heavily insulated for low temperature testing and could withstand static pressure to 60 pounds per square foot, positive or negative. A 50 hp centrifugal blower provided positive pressurization by feeding air to a port in the base of the pressure cell. Static differentials were recorded on water manometers. Blower connections were reversed for negative tests and restrictors placed on the blower outlet to ensure that predetermined pressure differentials were not exceeded.

For temperature differential testing, air temperature at the static pressure cell was raised to 150 F and lowered to —60 F. A kerosene-fired forced warm air machine provided heating with 250,000 btu per hour capacity at a maximum air outlet temperature of 250 F. Hot air was fed through a short length of flexible conduit to a port in the static pressure cell. For cooling, slabs of dry ice totaling 1,400 pounds deadweight were set in three racks loaded outside the pressure cell. Three fans vertically above the ice gave forced air circulation. Temperature control could be effected by selective operation of the fans.

A spray boom running the full width of the static pressure cell was clamped at the top of the curtainwall specimen to check for leakage.

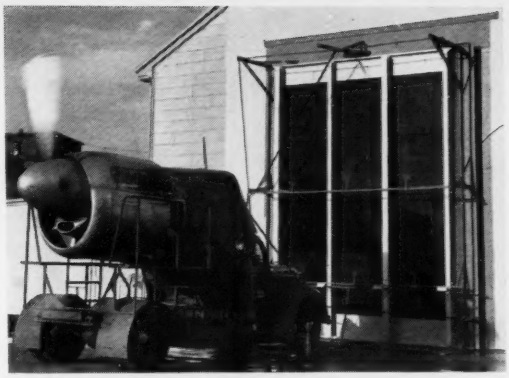
Using a jet engine

During dynamic wind pressure and water infiltration tests the static pressure cell was removed and a wind generator positioned in front of the test specimen. Two types of generator were used: a truck-mounted Rolls Royce Merlin 724 driving a three-blade propeller and a Canadair jet trainer fitted with a Pratt & Whitney JT-12 Turbo-Jet engine. Both could produce wind speeds to 130 mph but jet power was always used when outside air temperature was below freezing since the heating effect of the jet stream prevented ice formation from the water spray.

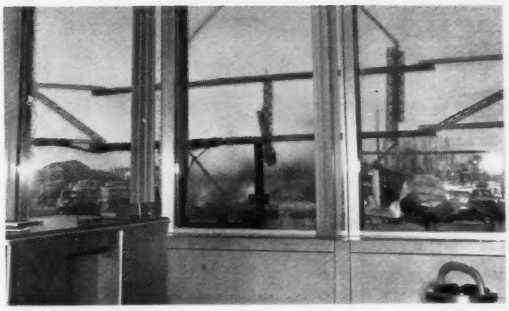
Two types of water spray manifolds were used for dynamic water infiltration tests: a triple bar rig carrying 9 spray nozzles and an octagonal ring main drilled to provide a series of small spray holes.

For instrumentation equipment Canadair's engineers were able to draw on the entire resources of the company's aircraft and missile test facilities. In addition to standard items, such as thermocouples, dial gauges and air speed indicators, they used large capacity vibration and fatigue testing machines, recording oscillographs, strain inducers, transducers and automatic temperature recorders.

The development facility comprised a mobile steel framework carrying two standard mullions and associated assemblies. Component development and appraisal procedures were extensively used to determine sealing system efficiency at critical points in the curtainwall. Both static pressure and dynamic tests were conducted as well as investigations of limits and fits of parts.



The prototype test facility relied on a Rolls Royce Merlin engine as a wind generator.



Looking out from the model executive office. Note the jet aircraft, center right.

For static testing, a wooden pressure cell was mounted in front of the test specimen. A 20 hp blower provided pressuring air while a spray bar gave water flows to 800 gallons per hour. In practice, static pressures of 40 pounds per square foot were common, and ultimate loading to 90 pounds per square foot has been performed.

Testing with 200 mph winds

Two 20 hp centrifugal blowers provided air for dynamic testing and wind speeds to 200 mph were attained during water infiltration studies of curtainwall sealing and expansion joints. Dynamic tests were performed with water spray of 800 gallons per hour directed at the part under investigation.

When the test and development program was finished, a continuing study of operational testing and research was begun under actual Montreal climatic conditions. Since the test specimen formed an integral part of a permanent building subjected to prevailing winds driving across nearby Cartierville Airport, it was possible to frequently monitor over-all performance in a highly exposed location. This was an operation test program embodying a policy of continuing architectural research and product development. And Canadair intends to do more. ★

W. H. Sheppard, B.Sc.

A new approach to friction damping

Friction damping need no longer be ignored in vibration calculations, says our author

In considering the vibration of mechanical systems it is well known that any form of decay influence causes a decrease in amplitude of successive cycles, or a gradual decrease in displacement in the case of overdamped or critically damped motion. Theoretically, if the damping is a function of the velocity, the motion continues asymptotically to infinity. In practice, internal friction causes a limit. In the past friction damping has usually been treated in a very cursory manner, and the effect of combined friction and viscous damping has been ignored.

This article seeks to work out the full theory for both friction and viscous-friction damping. It is convenient to consider the geometry of appropriate curves as a preliminary.

Geometry of curves

Consider the Archimedean spiral $\gamma = A\theta$. For analytical purposes, a spiral with increasing radius is shown in the accompanying sketch.

If this spiral is projected onto rectangular co-ordinates:

$$y = A\theta \sin\theta$$

If $y = 0$, $\theta = 0,\ \pi,\ 2\pi,\ 3\pi$ .....

$$dy/dx = A\,[\theta\cos\theta + \sin\theta]$$

If $dy/dx = 0$, $\tan\theta = -\theta$

$$d^2y/dx^2 = A\,[-\theta\sin\theta + \cos\theta + \cos\theta]$$
$$= A\,[2\cos\theta - \theta\sin\theta]$$

If $d^2y/dx^2 = 0$, $\theta\tan\theta = 2$

This corresponds to a sinusoidal curve, compressed between two straight lines and the tangent points midway between redeflection points.

It is possible to approximate this spiral by a series of semicircles, the involute of a short straight line. In this case the projection is a series of sinusoidal sections, the effective x-axis alternating at each reversal between two parallel straight lines. This is acknowledged to be an approximation, but curiously, has an exact application in mechanics, as will be seen later.

Simple friction damping

Consider a concentrated mass able to vibrate under the action of a spring or other elastic medium, with stiffness S and force of friction equal to F. In a simple system:

$F = \mu R$, where R = normal reaction and μ = coefficient of friction.

Let initial deflection = A. The effect of the force of friction is to introduce a force F always opposing the motion, and since the direction changes twice every cycle, a continuous function cannot be applied directly. Nevertheless, the effect is capable of mathematical treatment. The force F does not affect the frequency, but does cause the center of oscillation to be offset a distance $d = \frac{F}{S}$, in alternate directions.

Then, modulus of vibration, $\sigma = \frac{s}{m}$

and, frequency $N = \frac{1}{2\pi}\sqrt{\frac{s}{m}}$, period $T = 2\pi\sqrt{\frac{m}{s}}$

It will be realized that when the amplitude is exceeded by d the motion stops at a complete number of half-cycles. Then the number of semi-vibrations $n = \frac{A}{2d}$, taking the nearest whole number, the lower value being used if $\frac{A}{d}$ is integral.

The time taken to come to rest $t = \frac{n}{M}$. If the fraction of n is not discounted an approximate but quick result is given by $t = \frac{n}{N} = \frac{A\pi}{d}\sqrt{\frac{m}{s}}$ or $\frac{A\pi}{F}\sqrt{ms}$.

This gives the time to reach the point 0. The amplitudes are in arithmetic progression, the *C.D.* being $-4d$ for successive cycles or $-2d$ for half cycles.

Example

$S = 0.55$ lb/ft, $m = \frac{1}{2}$ lb, $A = 2''$, $d = 0.15''$

$$N = \frac{1}{6.28}\sqrt{\frac{0.55 \times 32.2}{0.5}} = 0.95 \text{ vibrations/sec.}$$

$$n = \frac{2}{0.3} = 6.8, \text{ say } 7$$

$$t = \frac{7}{0.95} = 7.4 \text{ seconds.}$$

Viscous friction damping

Under this heading a force proportional to the velocity acts in the same direction and since the velocity becomes negative for each half-cycle, the force mathematically opposes the motion. The

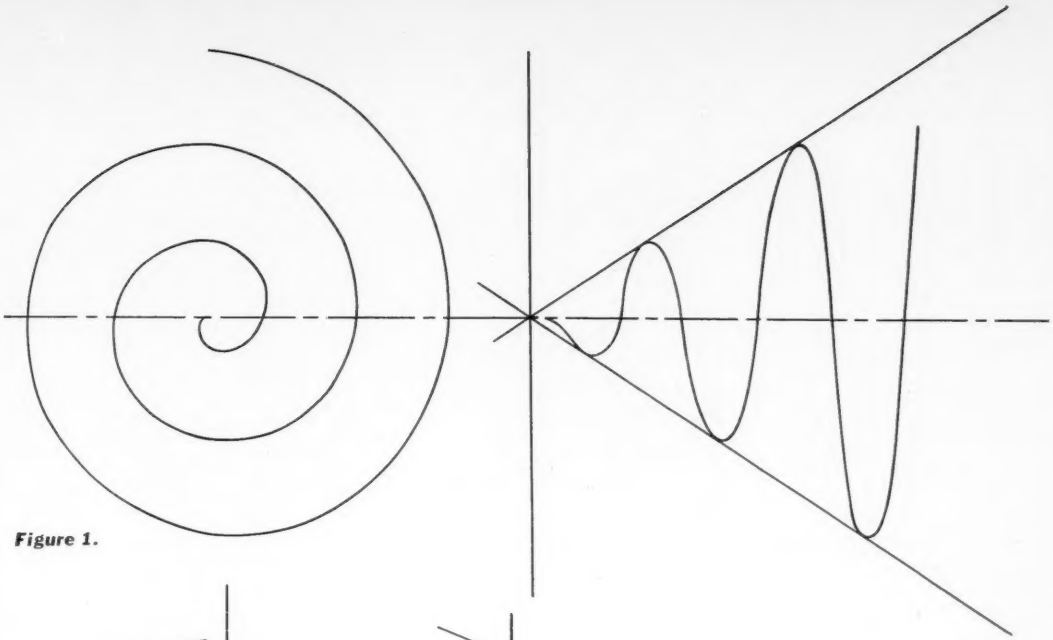


Figure 1.

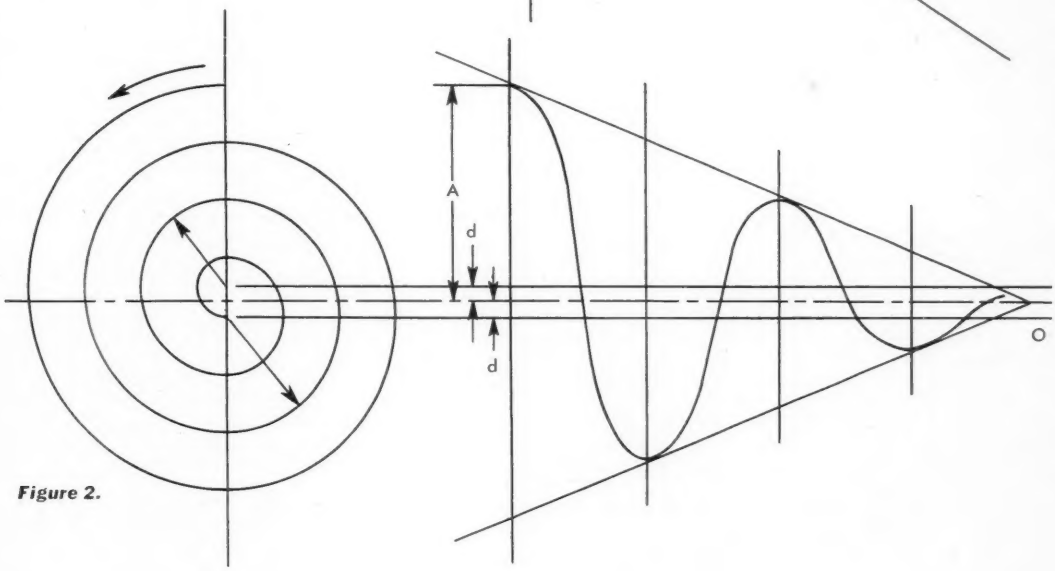


Figure 2.

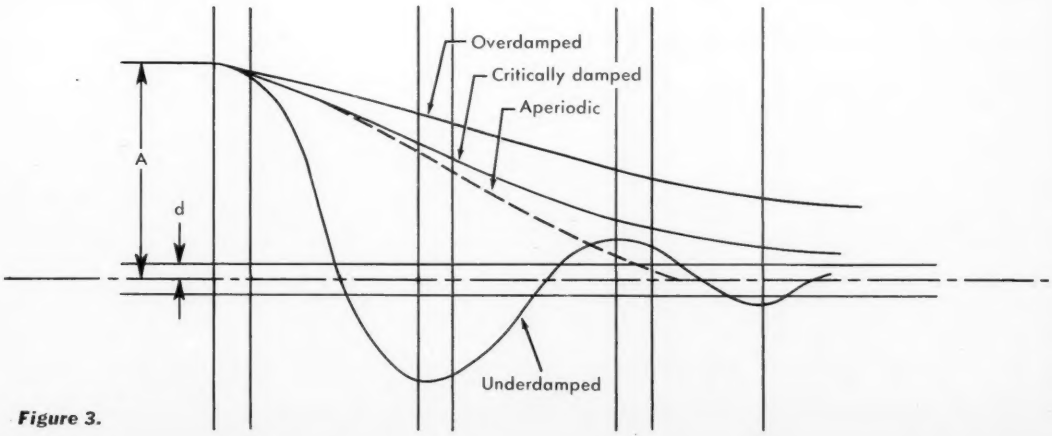


Figure 3.

effect of the friction must be considered alternately, however, as in the previous discussion. Two cases must be considered.

i. With vibration

The same general conditions apply, each amplitude being reduced in proportion to the previous until equal to or exceeded by d. In the first instance, let the last amplitude equal d and let r equal the ratio of each amplitude to that following, with respect to an offset datum.

Then, $\gamma = \frac{1}{\Delta}$, where Δ

= decrement for full vibrations = ξ^{δ}

$^{\delta}$ = logarithmic decrement

Thus *2nd* last decrement = $2d\gamma + d$

Thus *nth* last decrement

$$= A = 2d\,(\gamma^{n-2} + \gamma^{n-3} + \gamma^{n-4} \ldots\ldots 1) - d$$

$$= 2d\left(\frac{\gamma^{n-1} - 1}{\gamma - 1}\right)$$

If, however, the amplitude is less than d, A is the $(n+1)th$ term, and

$$A = 2d\left(\frac{\gamma^{n} - 1}{\gamma - 1}\right) - d$$

$$\text{or } \frac{\gamma^{n-1}}{\gamma - 1} = \tfrac{1}{2}\left(\frac{A}{d} + 1\right)$$

This may be solved for n, fractions discounted and $T = \frac{n}{N}$. In rare cases when the result for n is an exact integer, this must be decreased by 1.

The series for amplitudes is arithmetic-geometric. Thus:

$$C.D. = 4d \text{ and } C.R. = \Delta = \xi^{\delta}$$

Example

Using the previous example with $\gamma = 1.3$, $N^1 = 0.7$. (Actually N^1 is dependent on, and may be calculated from γ or $^{\delta}$ and N but the calculations are omitted for simplicity).

$$\frac{1.3^n - 1}{1.3 - 1} = \tfrac{1}{2}\left(\frac{2}{0.15} + 1\right) = 7.17$$

$$1.3^n = 1 + 0.3 \times 7.17 = 3.151$$

$$n = \frac{\log 3.151}{\log 1.3} = \frac{0.4984}{0.1139} = 4, \text{ discounting fractions.}$$

$$\therefore t = \frac{4}{0.7} = 5.71 \text{ secs.}$$

ii. Without vibration

These are the overdamped and critically damped cases. The effect will be similar to that for viscous damping without friction, but since the effective amplitude will be less, the deflection can be found by,

$$s = d + \frac{A - d}{A} \times \text{(deflection without friction)}$$

It will be realized that the critically damped case is intermediate between the vibrating and overdamped cases as for pure viscous damping. If, however, aperiodic motion is required, i.e., coming to rest at the datum without vibration, the first vibration with respect to the offset datum must be considered as shown dotted. Then

$$\frac{d}{A - d} = \gamma$$

Torsional vibration

Similar effects apply, using θ for s and a moment for F.

Electrical analogies

Analogies apply for pure viscous damping, but in this case friction corresponds to hysterisis effects in the circuit.

The foregoing is the result of a thorough investigation into the whole field of friction damping, including combination with viscous damping. As explained, results are applicable to linear or torsional vibrations and electrical analogies. Effects in electrical instruments are also applicable, pivot friction causing friction effect and damping by air resistance and eddy currents causing viscous damping. ★

New products and materials

Electronic pyrometer

A new panel-mounting pyrometer that enables measuring control of temperatures at distances up to 10,000 ft. All transistorized, it operates on signals from a thermo couple. **Metronix Inc.**

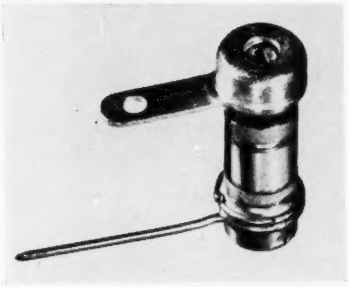
Circle 303 on Reader Service Card

Watt transducers

A new watt to milliampere or millivolt single or 3 phase transducer using a "Hall" crystal rather than thermal elements to give an output proportional to the watt input. Feature is virtually instantaneous response. **Canadian Westinghouse.**

Circle 304 on Reader Service Card

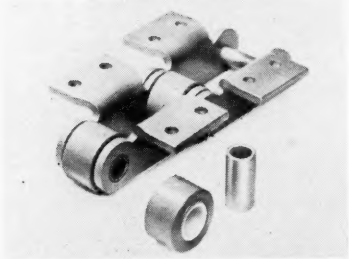
Glass capacitors



A new line of fusion-sealed glass capacitors that provide environment-proof performance at low cost. Made with leads that can be welded, the alternate layers of conductive foil and thin glass dielectric are fused into impervious monolithic units. **Corning Glass Works.**

Circle 305 on Reader Service Card

Plastic roller bushes



A line of steel conveyer chains available with new Delrin-bushed rollers. The new bushings are highly resistant to moisture and retain strength and size when wet. Quiet operation is a feature. **Rex Chainbelt Canada Ltd.**

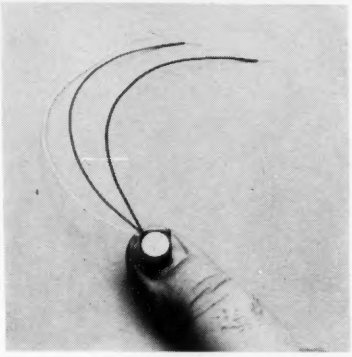
Circle 306 on Reader Service Card

Power rheostat

A completely enclosed dust proof rheostat having a push-pull action. Capable of use at full wattage rating with as little as 25% of its winding in use. Two brushes assure finer adjustment and greater dependability. **Milwaukee Resistor Company.**

Circle 307 on Reader Service Card

Trimming potentiometer



A new line of precision subminiature trimming potentiometers only 3/8ths of an inch square and claimed to be the smallest of the kind. Available in 72 standard models, they are suitable for matching, balancing, and adjusting vaiables in all types of precision control. **Daystrom Inc.**

Circle 308 on Reader Service Card

Self-crowning bands

Coated abrasive bands and belts which assume any desired degree of crown when run on inflatable rubber drums. Suitable for stock removal and polishing they are recommended for offhand work in confined areas, particularly on concave or other contoured surfaces. **Behr-Manning (Canada) Ltd.**

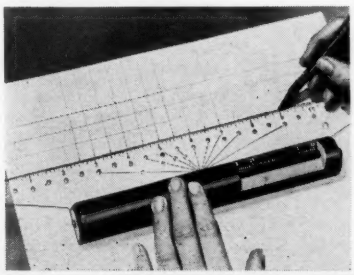
Circle 309 on Reader Service Card

Decade counter tube

A cold cathode gas filled decade counter tube providing an output pulse of such magnitude that the usual interstage coupling amplifier is not needed. Indication is provided by an orange-red glow discharge seen through the dome of the tube envelope at the end of the electrodes. **Philips Electronics Industries Ltd.**

Circle 310 on Reader Service Card

Calibrated ruler



A new West German 12 in. plastic ruler which is a combination triangle and T square. Automatically measures distances for vertical, horizontal and angular parallel lines. Built-in rollers allow smooth, easy movement up or down when drawing lines. Spiral index window automatically indicates distances as close as 1/16th of an inch. **B. C. L. Equipment Co. Ltd.**

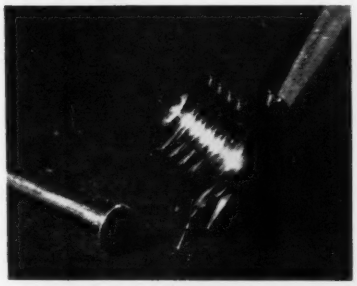
Circle 311 on Reader Service Card

Transmitting rotameters

A new series of transmitting rotameters designed for super pressure flows of up to 50,000 psi. They are claimed to be the first variable-area-type flowmeters ever offered for super pressure services. **Brooks Instrument Canada Ltd.**

Circle 312 on Reader Service Card

Axial seal



A sealed axial seal providing a jewel end bearing at either end of a gimbal within a fluid filled gyro. It permits an axial adjustment of the gimbal for its proper orientation with respect to the gyro case. **Mechtronics Corp.**

Circle 313 on Reader Service Card

Epoxy coated glass

A new epoxy coated glass fabric with good electrical properties and resistance to heat. A combination of a specially formulated high temperature resin coating and an inorganic woven glass fabric. **Minnesota Mining & Manufacturing of Canada Ltd.**

Circle 314 on Reader Service Card

Power relay

A four-pole power relay occupying approximately the same space as conventional two-pole relays. Claimed to have a life in excess of ten million operations at a maximum of two cycles per second with 50% dwell time. **Potter & Brumfield.**

Circle 315 on Reader Service Card

Push release latch

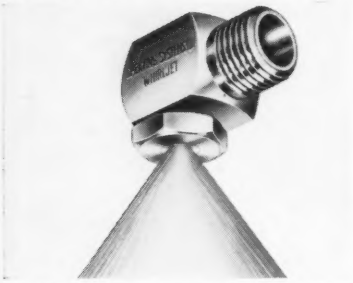
A completely concealed gravity push release latch for recessed or surface

(Continued on page 54)

mounted light fixtures. The open-close action requires only 1/16th of an inch vertical release travel and the nylon cam strike is engineered for operation with plus or minus 1/16th of an inch horizontal misalignment. **Stanley Works of Canada Ltd.**

Circle 316 on Reader Service Card

Spray nozzles



A hollow-cone, vortex-chamber spray nozzle has been patented in larger capacity half-inch inlet sizes. Claimed to provide unusual resistance to the erosive effects of vortex flow. **John Brooks & Company Ltd.**

Circle 317 on Reader Service Card

Precision potentiometer

A new type of portable precision potentiometer which gives an accuracy within 0.01% of nominal output, or 10 microvolts, whichever is greater. Stability is claimed to be within 0.01% of nominal output per year. **Orenda Engines Ltd.**

Circle 318 on Reader Service Card

Overload relay

A compact overload relay that compensates for both heat and cold, operating at all temperatures from —20F to 165F. No field adjustment is needed as automatic compensation is achieved by a balancing bi-metal located in a compartment separate from the working bi-metal. A preset and sealed calibrating screw permits a precise setting for the exact current required. **Arrow-Hart & Hegeman (Canada) Ltd.**

Circle 319 on Reader Service Card

Clinch nut

A new floating clinch nut. Self retained type blind fasteners provide load bearing threads in thin sheet metal assemblies such as electronic chassis, panels and cover plates. **Elastic Stop Nut Corp. of America.**

Circle 320 on Reader Service Card

High temperature nut

A new elevated temperature lock nut of nickel-base alloy intended for use at temperatures up to 1,400 deg F. Minimum tensile strength rating at room temperature is 180,000 psi. **Standard Pressed Steel Co.**

Circle 321 on Reader Service Card

Plastic transparency

A new visual communications system which enables a plastic transparency to be made from almost any document in less than 10 seconds under normal light. Immediate projection is possible in a fully lighted room. **Minnesota Mining & Manufacturing of Canada Ltd.**

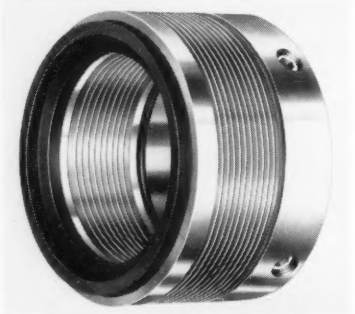
Circle 322 on Reader Service Card

Medium duty caster

A new medium duty caster has been designed to incorporate many of the features previously found in the heavy-duty type. Both top plate and yoke are accurately forged from ¼ inch steel plate. Heat treatment and "rolled-in," work hardened raceways give longer wear. **United Steel Corporation Limited.**

Circle 323 on Reader Service Card

Bellows seal



A new rotating bellows seal that will accommodate temperatures from minus 350F to plus 800F. Heart of the seal is a welded, stainless steel bellows attached to a drive collar at one end and a carbon retainer for the carbon sealed ring at the other. All dynamic elastomers have been eliminated. **Sealol Inc.**

Circle 324 on Reader Service Card

Reversing valve

An all-metal, four-way reversing valve featuring true hermetic valves with full ported poppet type pilot valve and plastic incapsulated coils. Pilot valve is rigidly mounted to the main valve, permitting a shift of the main slide valve with both low and high system pressures. Suitable for control of refrigerants. **General Controls Co. Canadian Ltd.**

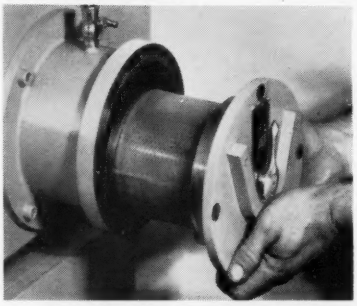
Circle 325 on Reader Service Card

Flowmetering system

A new system designed to withstand the continuous passage of sewage sludge and to provide an accurate linear measurement and record of its flow. Comprises an obstructionless flow primary element mounted in the sludge line and a transistorized recorder. Automatically controlled heating prevents grease from grease from building up within the tube. **Ficher & Porter Co.**

Circle 326 on Reader Service Card

Tell tale filters



A submersible type of filter that projects through a hole in the wall of a tank. A dirt indicator on the cover plate shows when the filter needs cleaning. Can be cleaned from outside the tank without draining. **Howard Marten Co. Ltd.**

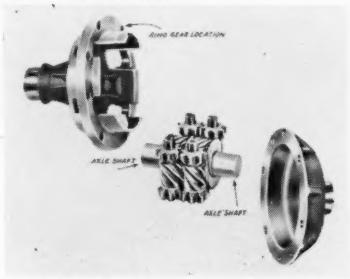
Circle 327 on Reader Service Card

Heating sentry

A built in linear heat-limiting device which can be located to protect the entire length of the heating element. The heater is limited to safe normal operating temperature when air flow is restricted either completely or partially. Maintains heat in the area-cycling on and off as necessary and automatically returns temperature control to the thermostat when the air blackage is removed. **Markel Electric Products Ltd.**

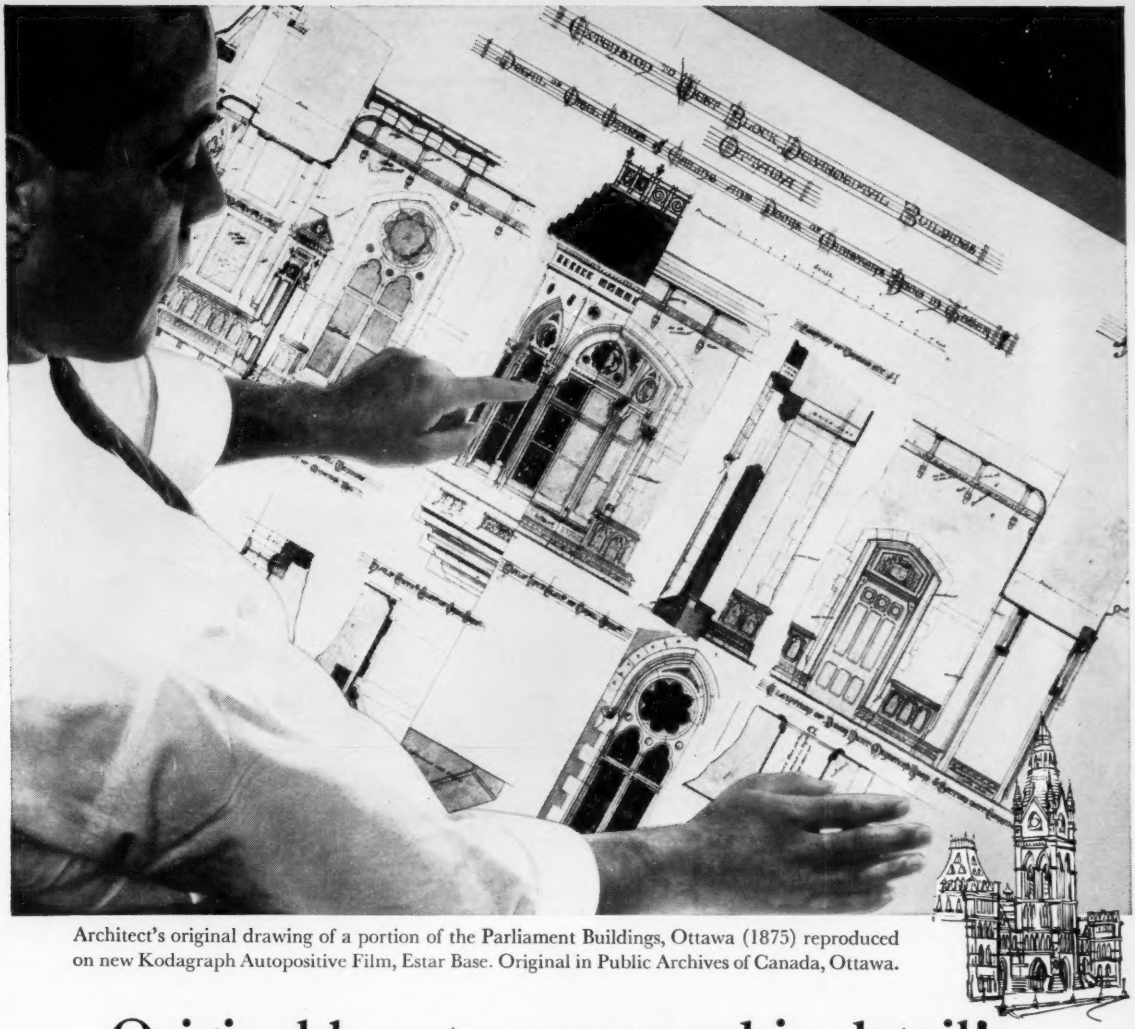
Circle 328 on Reader Service Card

New differential



A differential consisting of two basic operating parts: a balancing gear and a side gear. In operation, worms on axle shaft mesh with worm wheels to assure positive drive under all conditions. It has no clutches, springs, locks or manual controls. **Dual Drive Inc.**

Circle 329 on Reader Service Card



Architect's original drawing of a portion of the Parliament Buildings, Ottawa (1875) reproduced on new Kodagraph Autopositive Film, Estar Base. Original in Public Archives of Canada, Ottawa.

Original beauty preserved in detail!

New Kodagraph Autopositive Film, Estar Base, gives you intermediates that are as tough as they come and have exceptionally sharp detail.

Here's the ideal choice for general reproduction work and drafting-room use. Same-size, positive intermediates are produced directly without a negative step. And there's the added convenience of being able to expose and process under room light. Excellent results are obtained with either "print-through" or reflex printing, even when reflexing from metal templates.

See this versatile new Kodagraph Film — and the others in the new *Estar Base line:* Kodagraph Contact Film; Kodagraph Projection Film.

All combine reliable Kodak emulsions on the new Estar Base—highly translucent, durable, and dimensionally stable, with excellent matte surface on both sides for easy drafting. Available in standard drawing sheet sizes and in rolls up to 52 inches wide. Call your local Kodagraph Dealer, or write Canadian Kodak Co., Limited, Toronto 15, Ontario.

NEW!
Kodagraph

REPRODUCTION FILMS
for best line-for-line reproduction

Kodak
TRADEMARK

For further information mark No. 111 on Readers' Service Card

Overheard in Ottawa

Defense orders may jump $15 million

DE's Ottawa correspondent Richard Gwyn reports . . .

Canadian companies may soon be reaching for a bigger slice of U.S. Defense Department contracts.

A recent increase in the Canadian Defense Production Department's appropriation for "establishing productive capacity" could jump Canada's share of $30 million worth of U.S. contracts in 1960-61 to $45 million the next year.

The appropriation is used to help Canadian firms absorb pre-production costs to improve their competitive position when bidding against American firms which have already written off such expenses.

Defense Production matches dollar-for-dollar the manufacturers' pre-production costs to a limit of 10% of the contract price. This means the department's share is never more than 5% of the total.

Supplementary estimates increase the 1961-62 appropriation by $500,000 to $1,750,000.

Electronics protection

New excise taxes levied in the budget on electronic tubes and radios will provide an extra measure of assistance to Canadian manufacturers competing with low-priced imports.

But the extra protection is not large. Only the cheapest electronic tubes for consumer products are affected, while protection for domestic-made radios is more substantial.

This is what has happened. Excise tax of 15% has not been changed, but a basic minimum charge, irrespective of the value of the product will now be levied. It is $2 on radio sets and 10 cents on tubes.

The least expensive imported radio set will bear at least $2 unless the standing excise tax of 15% of landed value exceeds this amount. Thus the 15% will be applied. Break-even point where radios will bear the minimum $2 is around $13, manufacturers price. Break-even price for tubes is about 65 cents.

Japanese entry

The way has been opened for Japanese manufacturers to locate plants in Canada.

Canada's Immigration Minister Ellen Fairclough said there would be no objection to allowing entry of Japanese nationals of an executive or technical status necessary to establish plants resulting in the employment of Canadian workmen. Her statement was made following a meeting between the Canadian and Japanese Prime Ministers in Ottawa.

Expense accounts

The Canadian government is about to clamp down on the free-handed use of the expense account as a tax deduction.

In the budget, Finance Minister Fleming took no action on the matter but warned: "I am hopeful that more stringent legislation will not be necessary."

He said claims for expense account deductions would be more carefully checked in future by National Revenue officials. Mr. Fleming said: "The question is to what extent amounts spent by a firm for the entertainment of its customers and the traveling expenses of its employees are really required to gain income." ★

Briefs

Electronics: Japan's biggest profit-making company is surprisingly not a manufacturer of electronic and electrical equipment—it's the Bank of Japan; but second largest earner is **Hitachi Limited,** manufacturers of heavy and domestic electrical equipment ranging from transformers to television sets and scientific equipment . . . CBS Electronics will discontinue its TV receiving tube operations to concentrate in the fields of semiconductors, microelectronics and **"sophisticated"** electron tubes . . . USAF Electronic Systems Division has awarded Illinois Institute of Technology a **$2 million** contract to analyze and control radio interference at home and abroad . .

Energetics: Estimates shows that $7,500,000,000 worth of electrical **generating equipment** will be installed throughout Great Britain in the next ten years . . . a **marriage** of chemical and electrical energies is now being negotiated to provide an economical heat source for industry (if any marriage can be called economical); a burner boosts the energy from ordinary combustion of a fuel-oxidant mixture by superimposing on the flame electrical energy from a low-current, high-voltage, alternating-current discharge . . .

Athletic engineers: Engineering students are sometimes accused of chaining themselves up to their **books** and not getting out into the playing fields enough. The University of Illinois was determined to disprove this and won its case with the results of survey. It found that sixteen percent of the members in its sporting squads were engineering students. Engineers were best represented at **tennis** with 44%, fencing 23%, cross-country 20%, wrestling 18%, baseball and basketball 17%. The survey showed no engineering students participating in **golf** or gymnastics . . .

Material news: A man you can easily see through is now sitting in a New York laboratory; made of transparent butyrate plastic and named REMAB (Radiation - Equivalent - **Manikin** - Absorption) he is used to measure radiation absorbed by a corresponding human being through bones, soft tissues and organs . . . Crucible Steel Company of America is now marketing new electric furnace and open hearth **specialty steels** vacuum treated in a Dortmund-Horder unit at its Midland Works . . . the recent

(Continued on page 58)

Briefs — *continued*

successful concentration of domestic **beryllium** ores by a flotation process, using chemical reagents, assures a good supply of the metal for the future . . . commercial production has begun of lead acid storage batteries that use **modacrylic fibre** envelopes for insulating and holding active material in position on the positive plate . . . rubies, sapphires and silicon carbide crystals needed for advanced electronic devices will be **grown** in a new multi-purpose, high-intensity, arc imaging furnace at Arthur D. Little Inc., Cambridge, Massachusetts . . .

Tractor gift: The donation of two Canadian-made tractors to a small island (not Cuba) recently took Jim Gourlay of Toronto 600 miles inside the **Arctic Circle** on a servicing trip; the product and service instructor for Massey-Ferguson, he summarized the vehicles which replace the traditional dog teams for a party of scientists on ice-clad Devon Island . . .

Talepiece: A "supervisor" is one who has practically nothing to do. That is, except to: decide what is to be done; tell somebody to do it; listen to reasons why it should not be done; follow up to see if it has been done; enquire why it has not been done; follow up a second time; and consider how much simpler and better it would have been if he had done it himself in the first place.

"Try referring to this. It's a filter man's thinker!"

New standards

The following new standards have recently been published. They are available through Canadian Standards Association, 235 Montreal Road, Ottawa 2, Ont. Publications of the International Electrotechnical Commission are also available through CSA.

C22.2 No. 56-1961 — Flexible Metallic and Liquid-Tight Flexible Metal Conduit:

This third edition applies to liquid-tight flexible metal conduit in sizes ⅜ inch to 1¼ inches, and to flexible metallic conduit in sizes ⅜ inch to 4 inches intended for use as a metal raceway in the installation of wires, cables or flexible cords, in accordance with the Canadian Electrical Code, Part I. In addition, it applies to special purpose flexible metallic conduit in 5/16 inch size intended for other applications requiring the conductors to be enclosed in a flexible metallic raceway.

Liquid-tight flexible metal conduit covered by this Standard is provided with an overall thermoplastic covering which is recognized for use at a maximum working temperature of 60C (140F) or 75C (167F), depending upon the grade of the thermoplastic covering. **Price $1.75**

I.E.C. Publication 123: Recommendations for Sound Level Meters (First Edition):

This first edition contains recommendations for a general purpose sound level meter, intended for everyday use. Measurements are to be made in terms of three arbitrary weighting curves, with respect to a reference pressure of 2.10-5 M/m^2.

This publication contains the following sections: Scope, Object, Definitions, General technical characteristics, Microphone characteristics, Characteristics of the indicating instrument, Amplifier characteristics, Calibration and checking of the sound level meter, Marking. Descriptive leaflet. **Price $3.20**

I.E.C. Publication 48: Rules for Electric Traction Motors (Fourth Edition):

The main change in this fourth edition with respect to previous editions, lies in its extension to cover compound-wound motors and motors supplied with pulsating current. It applies to traction motors for tramways, railways, trolleybuses, and electrobuses.

This publication contains the following sections: Scope, Definitions, Temperature-rise tests, Overspeed test, Starting tests, Commutation tests, Dielectric tests, Determination of characteristic curves, Supply voltages of traction systems. **Price $3.20**

Technical literature

Directional control valves — Bulletin describing series of multiple unit valves for use on hydraulically operated mobile equipment. Vickers-Sperry of Canada.

Circle 330 on Reader Service Card

Slotted Angles — A revised handbook illustrating a wide range of applications and new accessories. Dexion (Canada).

Circle 331 on Reader Service Card

Piezoelectric devices — 16-page booklet on the application of piezoelectric devices highlighting new developments in highpower handling abilities. Edward Howard & Co.

Circle 332 on Reader Service Card

Mercury Lamps—Technical booklet with information on lamps, auxiliaries and their applications. Canadian Westinghouse Ltd.

Circle 333 on Reader Service Card

Drafting efficiencies — Planning guide portraying equipment advances designed

(Continued on page 60)

Technical literature— *(Continued)*

to reduce fatigue, save floor space and increase individual draftsman efficiency. Hamilton Manufacturing Company.

Circle 334 on Reader Service Card

Cellulosic plastics — Pamphlet describing properties of cellulosic plastics and their application in commercial and industrial products. Eastman Chemical Products.

Circle 335 on Reader Service Card

Roll caliper — Bulletin describing roll caliper gauge for checking roll accuracy against pre-determined standards. Parker Imports Ltd.

Circle 336 on Reader Service Card

Precision bearings—Catalogue in technical handbook has information on a range of more than 500 types and sizes of miniature and instrument size bearings. Miniature Precision Bearings Inc.

Circle 337 on Reader Service Card

Speed Measurement—12 page bulletin describing a complete line of ac and dc tachometer generators and indicators. Canadian General Electric Co. Ltd.

Circle 338 on Reader Service Card

Strip Chart Recorders—16 page catalogue describing new panel and portable recorders. Canadian Research Institute.

Circle 339 on Reader Service Card

Protective Overlays—Booklet explaining the use of protective overlay fabrics of Modacrylic fiber to overcome problems of wear, weathering and chemical attack from glass reinforced plastic laminates. Union Carbide Canada Ltd.

Circle 340 on Reader Service Card

Reinforced Polyester Structures—An 8 page study of "Design Considerations for Applying Reinforced Plastics in the Corrosive Invironments of the Process Industries." Atlas Powder Co. Canada Ltd.

Circle 341 on Reader Service Card

ASTM Publications—62 page list of publications available through the American Society for Testing Materials.

Circle 342 on Reader Service Card

Diminutive Electro-Mechanical Devices —A new handbook designed to assist in

Technical literature—*(Continued)*

selection and application of electromagnetic clutches and brakes, mechanical clutches, torque indicators, torque standards and multi-speed transmissions. Autotronics Inc.

Circle 343 on Reader Service Card

High-Voltage Testing—A complete engineering application analysis entitled "High-Voltage Testing—It can be nondestructive." Associated Research Inc.

Circle 344 on Reader Service Card

Commercial Glasses—Expanded data on corrosion resistance in thermal expansion of 32 commercial glasses. Corning Glass Works.

Circle 345 on Reader Service Card

Molded Packings—A selection guide to assist in the choice of the appropriate shape and grade of material to suit working conditions. Bestobell (Canada) Ltd.

Circle 346 on Reader Service Card

Co-ordinate Measuring—Catalogue on a new machine for measuring the distance between holes and surfaces in two dimensions to an accuracy of better than .001. The Sheffield Corp.

Circle 347 on Reader Service Card

Sintered Titanium—4 page bulletin outlining the potential of sintered titanium as a design material. The Jayme Organization Inc.

Circle 348 on Reader Service Card

Welded Structural Connections—A new manual for structural engineers, designers and students, summarizing current practices. Lincoln Electric Co. of Canada Ltd.

Circle 349 on Reader Service Card

Steel Construction—Technical bulletin with steel construction design specifications. Canadian Institute of Steel Construction Inc.

Circle 350 on Reader Service Card

Precision spacers — For a new four-page catalogue describing many thousands of types of standoffs in brass aluminum and corrosion-resistant steel. W. Hobson & Associates.

Circle 351 on Reader Service Card

Cryogenic thermocouples — A folder of temperature conversion data on gold-cobalt versus copper thermocouples. Cryogenic Incorporated.

Circle 352 on Reader Service Card

Sprayed overlays — Technical data sheet discussing the selection of metal powders for sprayed overlays. Wall-Colmonoy (Canada) Ltd.

Circle 353 on Reader Service Card

Slotted angles — Booklet illustrating the use of jig studs in structures employing a series of repeated angles and frames. Dexion (Canada) Ltd.

Circle 354 on Reader Service Card

Circuit breakers — Pocket comparison guide showing the cost, space and maintenance advantages of circuit breakers over safety switches. Westinghouse Electric Corporation.

Circle 355 on Reader Service Card

Gray iron directory — The 1961 Buyers' Guide and Directory of Members of the Gray Iron Founders' Society, Inc.

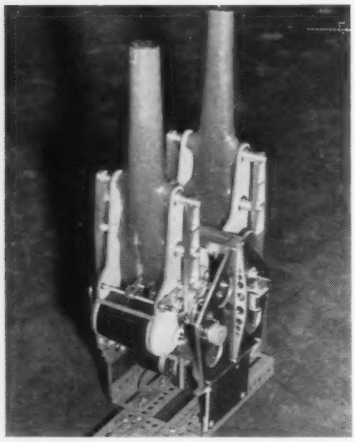
Circle 356 on Reader Service Card

Belt conveyors — Bulletin outlining a new concept in the engineering and fabrication of custom-built conveyors. Rex Chain Belt (Canada) Ltd.

Circle 357 on Reader Service Card

Satellite antenna passes test flight

The Canadian designed extendable space antennae (see DE June 1961) to be fitted to Canada's first satellite have successfully come through their environmental tests in the nose-cone of a Javelin rocket.



News has just been released that the rocket was fired 561 miles into the air from Wallop's Island, Virginia on June 14. In space the antennae obeyed a radio command from earth to extend to their full length of 75 feet.

A previous flight into space for the antennae in a U. S. Navy satellite proved their usefulness for bouncing radio signals off satellites through the ionosphere and deep into the ocean . . . a feat that opens possibilities of communications between land bases and submerged submarines.

The next role for the antennae is "depth-sounding" the ionosphere from Canada's first satellite when it goes into orbit early next year.

New phenol plants

Two plants in Alberta and British Columbia this month will help establish a new chemical industry for western Canada..

One, at Fort Saskatchewan, Alberta that is already supplying pentachlorophenol to the wood treatment industry plans to start turning out ethanolamines and glycols on August 15. On the same day a plant at Ladner, B.C. is scheduled to begin production of phenol.

Both are owned by Dow Chemcial of Canada Limited and represent a multimillion dollar investment.

Big Chile contract

An order worth $10,500,000 for the manufacture of all machinery and equipment for a paper mill in Chile has been awarded to John Inglis Co. Ltd.

The order was placed by Industrias Forestales S.A. which plans to establish the mill in southern-central Chile to turn out 60,000 tons of newsprint yearly.

A spokesman for Inglis said most of the work, amounting to more than 1,-000,000 manhours, would be done in the Toronto plant. The balance would come from other Canadian firms.

The spokesman said the order would probably require increased employment as the job progressed.

$2,860,000 grant

Ten postgraduate fellowships awarded by The International Nickel Company of Canada, Ltd. brings the total educational aid granted by the company in the past five years to $2,860,000.

The fellowships, this year, are for a maximum of three years offering an annual $2,000 stipend to the student and a $500 supporting grant to the university. Five are new fellowships and five are renewals of previous awards.

The ten students are completing advanced studies in a wide range of subjects including metallurgy, mathematics, physics, geology, geophysics and chemistry.

Production record

Production of goods and services in Ontario reached an all-time high in 1960.

Mainly responsible was a boost in mineral production and agricultural cash income. During the year mineral production reached a peak of $984 million, advance of $13 million. Cash income from farm products was a record $883.

However, the value of manufacturing shipments slipped slightly from $11.7 to $11.6 billion.

In 1960, Ontario gained 113 major new manufacturing industries while 29 established provincial manufacturers expanded to new locations. At least 561 firms undertook major expansions on their present sites.

Men on the move

Edward Boote of Peterborough appointed councillor in the electrical branch, Association of Professional Engineers of Ontario.

Dr. E. O. Hughes of Canada's National Research Council to serve as Scientific Attache in the Canadian Embassy, Washington, D.C.

William P. Park promoted general manufacturing manager, Ford Motor Company of Canada, Ltd.

Max Reading elected director, Foundry Services (Canada) Limited, Guelph, Ont.

Frank R. Pope appointed general manager, Westclox Canada Limited, Peterborough, Ont. E. S. Darby re-elected president, Association of Canadian Commercial Testing Laboratories & Consultants.

Reading

Dunton

Anker Gram appointed to newly created post of products research engineer, Sparling Tank & Manufacturing Co.

R. M. Dunton promoted manager of engineer, paper division, Dominion Engineering Co. Ltd.

Harry Webber appointed manager, engineering department, Canadian Westinghouse Company.

R. E. Seifert named semiconductor division manager, F. W. Sickles of Canada Limited, Waterloo, Ont.

Dr. Andrew Herczog, formerly research associate in metallurgy at University of Toronto, appointed senior research associate, Corning Glass Works, Corning, N.Y. Allan T. Jones promoted technical co-ordinator, S. A. Armstrong Ltd., Toronto.

For your calendar

August 3-5: The Chemical Institute of Canada, Canadian Chemical Conference & Exhibition, Queen Elizabeth Hall, Montreal.

August 6-12: 18th International Congress of Pure and Applied Chemistry, Queen Elizabeth Hall, Montreal.

September 6-8: Association for Computing Machinery, International Data Processing Exhibit, Statler Hilton Hotel, Los Angeles.

September 11-15: Annual Instrument-Automation Conference & Exhibit, Instrument Society of America, Biltmore Hotel, Los Angeles, California.

September 25-28: International Building Exposition & Congress, New York Coliseum.

October 17-19: The plastic Show of Canada, Automotive Building, Canadian National Exhibition, Toronto.

October 18-20: Gray Iron Founders' Society, annual meeting, Royal York Hotel, Toronto.

backlash

DE editors overworked?

Almost everyone who has to work for a living likes to claim he's overworked. We sometimes have the same problem at DE, especially when editors bring up the subject of opening the mail. Each week we have to sharpen our letter openers to de-envelope an average of 250 items (not including ordinary correspondence) dealing with everything from a new line of potentiometers being put out in Texas to the declaration of a 1c interim dividend by an obscure mining exploration company in Canada's north.

Something like eighty percent of the mail is of no direct interest to our readers and a surprisingly large amount of it has no bearing on design engineering. As a result, our overflowing waste-baskets are enough to give any office cleaner nightmares.

But the past month has seen some of the best examples of the high pressure of modern-day press agentry. A mid-west U.S. city's transit authority, in a letter personally addressed to our assistant editor, urgently announced "for immediate release" that motorman H.E.P., operators F.F. and S.M. and toolmaker A.W.B. had retired on pension, July 1, after combining a total of more than 170 years' service.

If this is really something for Canada's design engineers to get excited about, hold on to your hats for the news from a New York City processing firm. It has appointed a man with 25 years in the industry to the newly created position of manager of starch sales. His responsibility: sales of bulk and modified tapioca and potato starch. The only "technical" reference was in the last paragraph of the release where it began "Both technical and food grades of these specialty starches are . . . ". Just thought we'd like to keep you up to date on the important news.

Too many meetings?

One of the many things that plague all professional people is the multitude of meetings held each year by the various societies . . . and not the least of these are the engineering societies. If the editor of DE were to attend only one-half of the meetings to which he was invited, he would never have time for doing anything else.

The expenditure of time and money to attend all . . . or even part . . . of the available conferences is difficult, if not impossible, to justify. The result is that the engineer gets only a partial picture each year; and it takes only a few years to realize that he becomes totally out of touch with new developments in his field.

We are pleased to read that some of the professional and technical societies south of the border are taking some action on this important matter. Some of them are combining their activities . . . others are reducing the number of conferences which they sponsor.

Although in Canada we have not nearly as many conferences as in the U.S., already there are complaints of too much being done for, and by, too few. A great deal of effort goes into the organization of these conferences and the preparation of papers for them.

Perhaps it is time that an independent group of engineers, or management specialists, had a close look at the situation, before the matter gets too far out of hand. Possibly we need fewer of these meetings . . . with more effort on upgrading them. Perhaps we need a central "clearing house" for the control of the overall program (and we aren't thinking of an arrangement such as appears to be proposed in the present plans for "confederation" in Canada). Here again is an area where we feel the professional associations in Canada could lead the way, instead of ignoring the situation as though it did not exist.

Another Quebec innovation

Once again the professional engineers of Quebec province have come up with an idea that should be examined closely by all other provincial associations.

One of the common problems is enlisting the new engineer as soon as possible after graduation. Many graduates postpone the step until they find themselves in a position where registration is compulsory.

There's nothing like a public reception to impress the significance of a major professional step. The 'iron ring' ceremony has been handled in this manner for years.

Now the Quebec engineers have adopted this same idea in calling attention to the fundamental purposes and rules of the profession. They sponsored a banquet where the new graduates were presented with certificates of membership in the Corporation of Professional Engineers of Quebec. The ceremony was a resounding success. Each new graduate was accompanied by a senior engineer who acted as his sponsor.

Membership in an association of professional engineers is an important event in the business life. It is not sufficient to receive a cold, printed form letter announcing the event. Public acknowledgement of the occasion is just another way to help in advancing the cause celebre. We recommend the procedure tested by Quebec this year as a logical move for all associations. Perhaps the local chapters being organized in Ontario might like to make this one plank in their platform.

Misgivings in the U. S. too

Less than ten years after the U.S. and Japan signed their peace treaty and undertook a crash program to rehabilitate Japanese industry, there are claims that American business, in many lines, is being hurt by competition from the industrial machine its know-how helped to revive. The same claims, of course, are being heard in many industrial fields in Canada.

Some one has said that Japan is now thought of as the Land of the Rising Production Curve. Certainly they are pouring out goods in quantities and at prices that are more than competitive in the Americas.

Although the goods produced in Japan in pre-war days were oftimes shoddy, the present products are of high quality and find wide acceptance by American consumers. Electronic equipment, including transistor radios and television sets, batteries, photographic supplies, bicycles, toys, sewing machines, scientific apparatus, steel products and chinaware are but a few of the areas where the U.S. businessman has been hard hit.

Editorial

Should you accept this challenge?

. . . teachers of technical subjects are urgently needed in Canada

One of the most frightening things in this world is ignorance . . . we refer not only to a lack of knowledge, but more than all other, to the ignorance and fear that consists in not being adequately equipped to earn a living.

Thousands of potential wage-earners in Canada today are being forced to spend their hours in idleness because of this ignorance. The fault very often is their own, but this does not help to ease the weight of the problem. In some cases the man or woman is unable even to read or write (at least, in the working languages of this country); others have a basic education but never went further than the elementary grades; a few have even attended up to the high school level without developing any "employable" skills.

Now they are faced with a serious problem, serious not only to them as individuals, but serious to the country as a whole. There are just not enough jobs of the type that the uneducated can handle in this modern technological scheme of business to absorb all the available manpower.

Scientific technology has broken up the placid life familiar to our grandfathers. It has converted the man of general competence into a specialist. There is no appeal from the judgment that has been pronounced on the uneducated man. The only alternative is to educate him.

The men who guide the Department of Education in the province of Ontario have taken a couple of big, bold steps to provide the facilities necessary for the training of those who wish to learn a trade. The cost will run into millions of dollars, but it appears that the money will be a sound investment in the future of the province.

Item one on the program is a special series of courses for the adult unemployed. Operated under the auspices of the Provincial Institute of Trades, the courses provide an opportunity for those with up to Grade 10 basic education to gain trade training in a wide variety of skills. One experienced observer was overheard to say that the drafting course being given under this program was one of the best that has ever been offered in Canada.

Item two on the program looks even further to the future. A number of new and expanded technical schools will be constructed throughout the province within the next two years. Many of these schools will be in areas where now no comparable training is offered.

The major query in the minds of most of those who are involved in promoting this program is "Where are the teachers coming from?" As Harold Skinner says in his article on page 38, Ontario schools are crying out for technical teachers.

Here is an area where many an engineer or technician who feels that his talents are not being adequately used might find a great satisfaction. Salary levels have been upgraded over the past few years . . . special credits are given for degrees and extra training and experience. And the rewards cannot all be assessed at dollar value. The thrill of seeing a former pupil go on to make a name for himself in the world of business often brings greater reward than all the paychecks ever earned.

Doug Kaill

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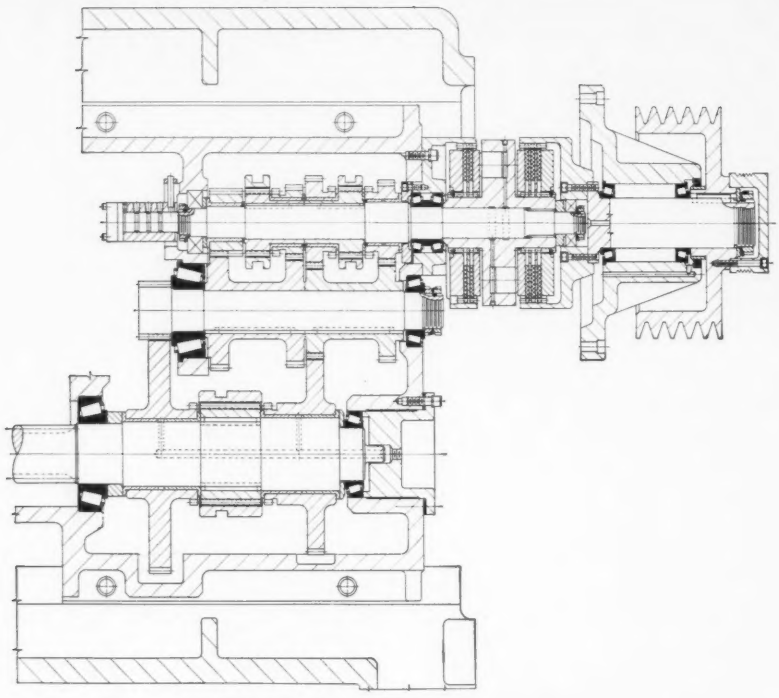

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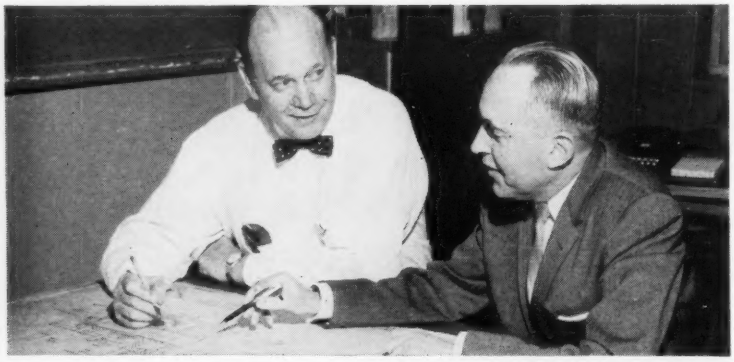

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